McGRAW-HILL DIGEST

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181 ITEMS IN THIS ISSUE

New Esso refineries are being built—many others are being expanded.

They Build an Answer

The world's demand for petroleum has reached an all-time high—and is still increasing! Today the need for petroleum is even greater than during the peak war year of 1945.

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This program of expansion will help to answer the world's need for petroleum. For where petroleum goes, comfort and convenience follow.

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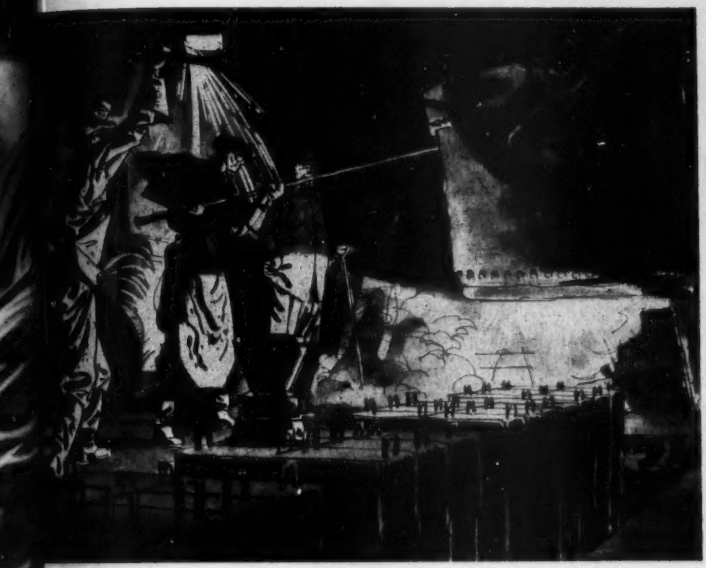

STEEL . . . Backbone of Good Living!

THIS is more than a picture of steel making. It reflects the whole world of science and industry and its goal: *good living for more people!*

Back of this broad industrial picture you see machines and equipment by Allis-Chalmers . . . giant reversing motors for steel mills, turbines for power plants, compressors for oil refineries.

Allis-Chalmers serves *every* basic industry—builds the world's largest line of major industrial equipment. Business and production men everywhere have confidence in Allis-Chalmers products for efficient, long-life, low-cost operation.

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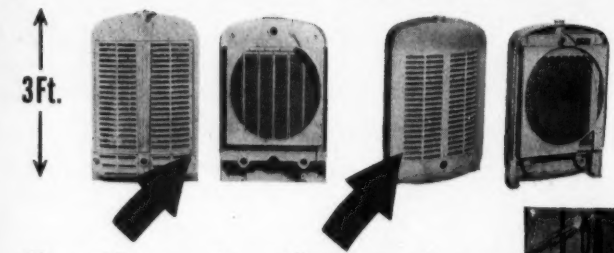


Casting-to-Stamping saves as much as 30% for Young Radiator Co.

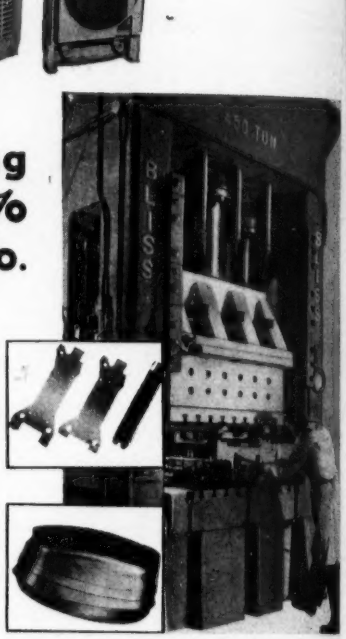
450-Ton Bliss Hydraulic Press solves delivery, weight and durability problems

To achieve lighter, stronger and more cleanly designed radiators for automotive and industrial applications, the Young Radiator Company, of Racine, Wis., manufacturers of quality heat transfer equipment, recently converted the outside casings, tanks and side members from castings to formed steel parts. As it has for 20 years, it chose Bliss to specify the press. The resulting savings have been as much as 30%.

Today, with this 450-ton single-action hydraulic press, the weight of the radiators has been more than halved, and the drawn tanks provide as much cooling and are more durable than their cast counterparts.

Bliss did more than build a press. It provided the vital engineering knowledge for maximum production. That's why 70% of Young's presses are Bliss.

This service and counsel are at your disposal. You'll find, too, that "Bliss" on your press is more than a name—it's a guarantee!



Feature of this Bliss Hydraulic Press which delights Young is its extreme flexibility: use of the outside cylinders for jobs up to 175 tons pressure; availability of full 450-ton pressure for heavier work, ability to accommodate off-center loads; quick advance and return; inching for die-setting and safety afforded by central push-button.

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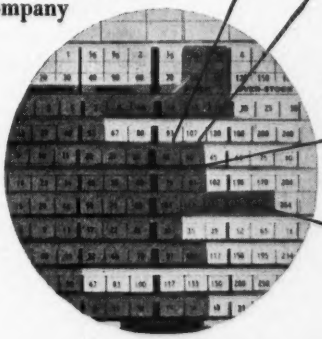

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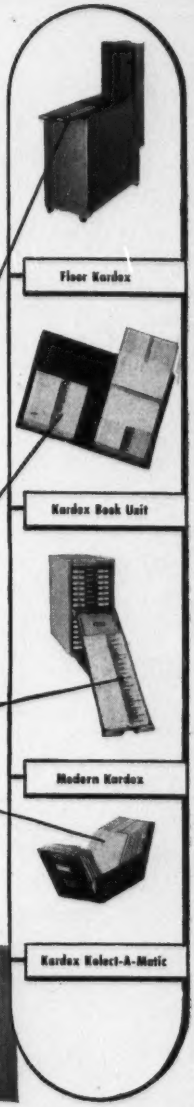

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BUSINESS TRENDS

Metal demand will remain heavy in U. S. Bad weather hurt steel deliveries—the coal strike may hurt them more. Gray-iron castings, thanks to pig-iron scarcity from breakdown of many furnaces at one time, are on the hard-to-get list and will likely stay there until late summer. Steel and non-ferrous castings are easier. Aluminum is critical with no relief in sight for months; demand exceeds supply and power shortage prevents full capacity mill operation. Copper situation may be upset by excessive government buying. European Recovery Plan demand will be filled, but only at domestic expense. Rearmament will make conditions worse.

Metalworking activity will continue at record peacetime levels through at least the first three-quarters of this year. Demand for durable consumer goods is sloping off, but new orders for capital equipment are trending upward. Wage increases and long-awaited tax cuts should be stimulants. Tax cuts also will increase capital flow by over 15% by savings concentrated in upper-income groups. More risk capital will mean easier financing of plants and equipment.

Demand for rubber products will continue at present high levels during 1948 with production of natural and synthetic rubber at record-breaking volume. Total output is expected to exceed $2½-billion this year—more than 2½ times the 1940 volume, only slightly less than all-time high of $2.7-billion in 1947.

Farm-machinery producers in allocating about $90-million worth of machinery and parts for 1948 export expect no great advance from 1947. If some of the large requests turned down at the Paris Conference are reinstated by government assignments to ERP, exports will increase appreciably.

Automotive exports from the U. S. and Canada during 1947 totalled $1,371,616,075, almost double the 1946 figure. Cars totalled 308,345; trucks 305,577; and bus chassis, 4,238. It is doubtful if this upswing will continue.

U. S. merchant fleet has dropped from 56-million deadweight tons to 39-million. Its share of world shipping carried has slumped from a wartime high of 65% to 31%. A third of the country's fleet is in mothballs—there just isn't enough tonnage to keep U. S. bottoms at work. A fight is brewing in Washington as to the advisability of building up ERP nations' fleets at expense of U. S.

Decartelization of Ruhr coal industry will be undertaken by Bizonia authorities. Coal mining operations will be cut from combines and placed on a self-support basis. Where combines exist in coal alone, they will be split into new corporations. Title to stock will be vested in U. S.-British appointed trustees. Mines will not be returned to original owners but payment therefore will be made.

Truck production at the Ford plant in Niehl, Germany (British Zone) is still far behind the 160 units per week produced before the war. Last year 2,600 units were completed. Coal, steel, and other shortages still handicap output. Now 3,300 persons, including many women and boys, are employed against a prewar figure of 4,500. Lack of food and low worker morale have also slowed output.

Western Germany's coal production passed the 300,000-ton-per-day goal early in March. But steel output is lagging behind the 7.6-million ton ceiling. British authorities promise to permit export of German steel as an incentive.

Production in Russia's zone of Germany is rolling rapidly downhill, so Russia is calling off her denazification proceedings. In western Germany, industry is climbing. U. S. sources estimate that 52% of the productive capacity of eastern Germany has been sent to Russia as war booty, not reparations. Along with munitions plants—textile and coal mining equipment and machine parts have moved east.

Automobiles will pass whiskey as England's top dollar earner temporarily as Britain's automobile manufacturers push export while demand for cars in the U. S. remains high. Sales may reach 20,000 units—a net sales value of $24-million for Britain. But it won't last. Americans like big cars, so Detroit is shrugging off the temporary spurt.

Russian-pressured trade deals with Sweden have been an indirect blessing to the Italian ball-bearing industry. Sweden's SKF, busy with Russian orders, are unable to handle requests from other countries. The Italian industry is making great strides to get back on its feet to fill orders from England, other European countries, and Latin America.

Russia is pushing steel production, now planning to complete 5-yr. plan in 4 yr. and reaching annual production of 25,400,000 tons in 1949. Eastern mill output rose 56% during the war and is steadily upward, while southern steel industry is operating near prewar capacity. Amount going into consumer goods is unknown.

Argentine five-year plan is due for a 75% cutback, at least for this year. Reasons —planners tried too hard to make plan impressive; Peron lacked sufficient trained engineers; 2-yr. spending spree has depleted the country's supply of dollars.

Brazil's unexplored Amazon Basin will soon be explored by UNESCO scientists to determine the area's ability to help feed the world and supply raw materials. The group is not interested in commercial possibilities of the area. Possible economic impacts of the survey are obvious—in mining, rubber, oil, and agriculture.

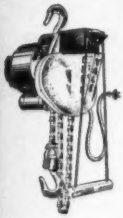
Australian coal production is getting a boost from U. S. mining machinery manufacturers who are issuing manufacturing licenses to Australian companies and from U. S. branch plants building machinery on the spot. Look for keen competition here between U. S. and British groups.

World food outlook is brighter today than at any time since prewar days. The U. S. winter wheat crop looks good; Europe's crop is coming along well, with acreage up; Russia should be able to increase exports; Australian crop doubles last year's; Argentina will exceed last year's output; rice harvests in the Far East were surprisingly good; India and China crops are progressing favorably. But the crisis is far from over.

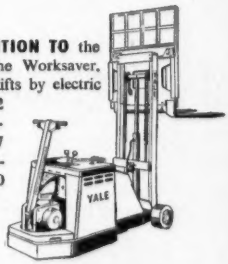
Parcel post by air from the U. S. to 21 foreign countries was started March 15 by the U. S. Post Office Dept. Service is not offered domestically. Parcels will be accepted at any post office in this country and will be carried by air domestically as well as to overseas destinations. Rates from any point in U. S. vary from $0.72 for 4 oz. to Newfoundland to $1.38 for 4 oz. to Belgian Congo.

Items on these pages come from McGraw-Hill magazines and news services.

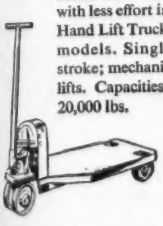
"ON THE MOVE" WITH YALE



JUST A FEW PENNIES A DAY —That's all it costs to operate the portable Yale Midget King Electric Hoist. Simply pull a lever and it handles loads from ⅛ to 2 tons with ease, speed and safety. Other Yale Electric Hoists to 12 tons . . . hand chain blocks to 40 tons.

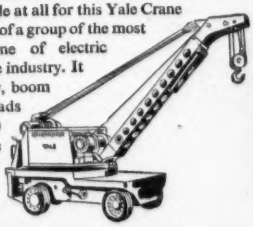


NEWEST ADDITION TO the Yale line is the Worksaver. It travels and lifts by electric power. Has 2 forward and reverse speeds. 7 styles. Capacities from 1,000 to 6,000 lbs.



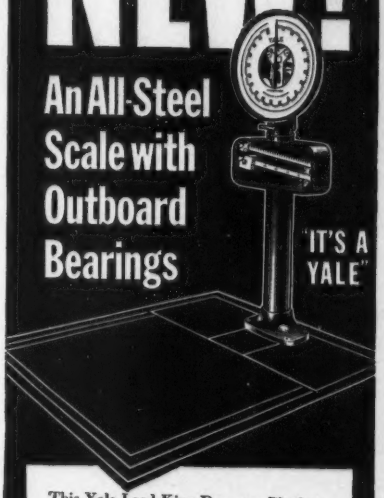
HANDLING MORE MATERIAL with less effort is routine for Yale Hand Lift Trucks. Wide range of models. Single and multiple stroke; mechanical and hydraulic lifts. Capacities from 1,000 to 20,000 lbs.

AWKWARD MATERIAL HANDLING JOBS are no trouble at all for this Yale Crane Truck—one of a group of the most complete line of electric trucks in the industry. It can lift, slew, boom and carry loads up to 10,000 lbs. with ease and speed.



NEW!

An All-Steel Scale with Outboard Bearings



"IT'S A YALE"

This Yale Load King Dormant Platform Scale bears an old reliable name, yet it is so modern in design that there's not another quite like it. Its special outboard bearing construction makes it impossible to tilt no matter where the load is placed on the platform. This means you cut weighing time, get prolonged accuracy, lowest possible maintenance costs, increased scale life. Capacity to 11,250 lbs. Other models to 60,000 lbs.

See your local Yale representative, or send for the latest Catalog R-TD. The Yale & Towne Mfg. Co., 4594 Tacony St., Philadelphia 24, Pa.

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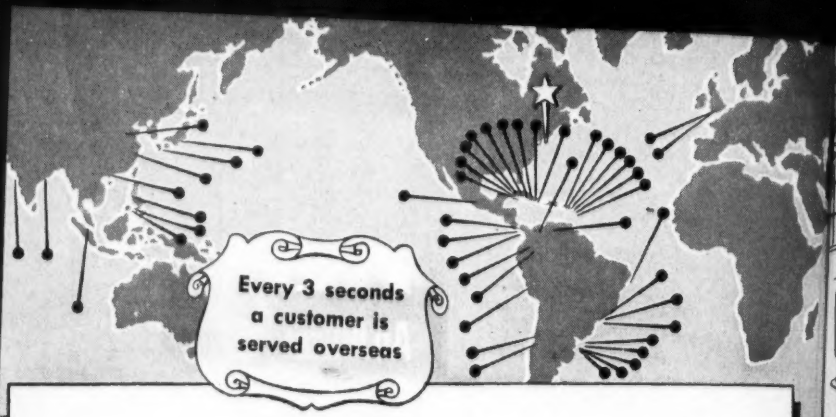

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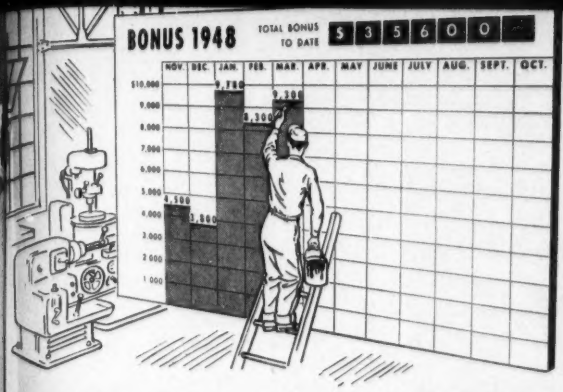


Profit-sharing bonus is posted each month in the factory so all employees can see where they stand. Monthly posting creates incentive factor—if the bonus is not posted on time, employees want to know why and when. For 1947 (from Nov. 1946 to Oct. 1947), the total bonus accumulation was $83,103.50, to be divided, according to percentage of earnings, to about 100 employees.

Profit Sharing Will Work

Properly presented profit-sharing plan increases productivity, stimulates ideas, creates cooperation, improves quality of product, and cuts rejects

PROFIT SHARING at the C. A. Norgren Co. was adopted to provide an incentive for self improvement, higher efficiency, salvage of waste, and forward thinking. It was believed that the worker, as well as management, should profit by improved performance. The plan was based on:

(1) Paying the going wage rate.

(2) Percentage bogey was established as company reserve for interest, repairs, replacement, and maintenance.

(3) All net income before taxes above bogey is shared with employees.

(4) Eligibility to participate begins at the end of 1 yr. service.

(5) Individual bonuses are figured pro rata on the basis of individual earnings to total earnings.

(6) Plan is established on a voluntary basis for 1 yr. at a time.

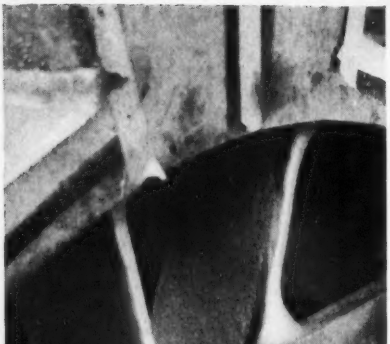
(7) To avoid discrimination in event of discharge or separation of an eligible employee, all such former employees receive participation for time worked.

Bonuses are paid once a year. But yearly intervals are too long for enthusiasm to continue unless there is a continuous, definite indication of how the bonus accumulation is progressing. This incentive factor is gained by posting in the shop a chart on which is noted each month the bonus credit and the total accumulated to date. This has the same effect as frequent payments.

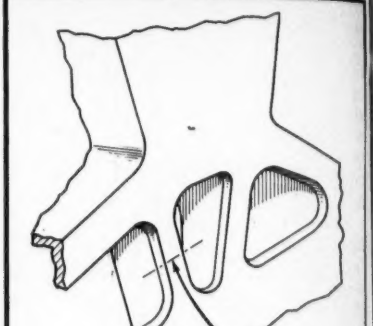
Results of the plan were multifold. The previous attitude of dissatisfaction shifted to one of cooperation. Production jumped. A greater volume of merchandise is being produced with less workers; 87 employees working 40 hr. per wk. are getting out more now than did 140 working 48 hr. per wk. during the war.

Rejects have dropped, and there has been a tremendous reduction in rework and salvage of material. A stimulating contribution to improved tooling and other speed-up methods, which all add up to greater output, has followed.

Labor turnover is now virtually nonexistent. From a wartime high of over 200% annually, it is now so low that it is entirely disregarded. All benefits added together has permitted keeping price increases to only 10% as contrasted to 50% increase in wages and from 20 to 100% in materials.—Am Mach, Mr 25, 83



END PLATE on engine frame is faired with metal to relieve distress in secondary joints



REDESIGN to avoid abrupt changes in metal section would correct trouble at low cost

Failures Tell Design Story

Study of the behavior of dynamically loaded, welded structures often reveals reasons for failures and what can be done in corrective design

WELDED-STRUCTURE behavior often demands a clinical study of failures to indicate future successful design. All too often overlooked is that a welded structure is one piece of metal and behaves as such.

Notches and incipient cracks, designed into a weldment for example, may reduce its endurance limit. While relatively unimportant in a statically loaded structure, this condition would be critical in a dynamically loaded structure in which endurance limit or fatigue characteristics should be the design criteria.

While the endurance limit obtained from a conventional test specimen increases approximately in proportion to the tensile strength, it is about the same for high- and low-strength materials when a sharp notch is introduced. This indicates little value in using expensive high-strength steels in notched dynamically loaded structures.

Reinforcements also may reduce fatigue strength in the presence of high-speed reversals of stress. Such constructions should not be avoided necessarily because many liberties can be taken in regions subject to secondary loading conditions. Judicious use of reinforcement is proper—at the right place so there is no interruption in the stress flow and a consequent stress concentration. An inner reinforcing member, to ease the contour change and avoid stress concentrations, may even be tapered at one end.

A mystifying type of failure, well adapted to clinical study, is that in which a purely secondary member shows distress, such as the end plate on a diesel-

engine frame. The plate has two slanting inner members that carry a primary load to resist the tendency of the firing load to increase the distance between cylinder head and main bearings. The short fillet weld connecting end plate with primary member at the bottom of the opening fractured and introduced notch effect in the edge of the primary member.

Repair was made by removal of defective weld and building up a gradual fairing by weld metal. The correction was based on elimination of abrupt changes in metal section or in stiffness of the structure at this point.

More thought on the elastic behavior of steel would have prevented the failure. Avoiding abrupt changes would have lowered the level of maximum stress induced by whatever conditions were causing the failure with only a slight reduction in the area of the opening.

Too Much Caution in Design

A radically different type of failure occurred in a jacketed steam drier roll. During testing, too great a hydrostatic pressure bulged the outer shell. No fracture causing leakage developed, and the one-sided corner welds, although notched on their inner sides, did not fail.

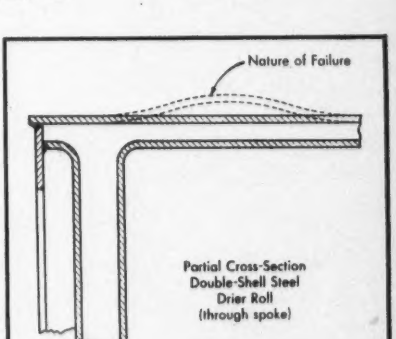
This failure shows that some designers err in the direction of too much caution. When blueprints specify "full-strength" welds at every joint, each one must be fused completely throughout the full metal thickness and is subject to meticulous inspection. This means an extremely costly weldment, and few weldment designs require such full-strength joints. Pressure vessels are excepted, but even here the exception is confined to thick-walled vessels subjected to high pressures.

These examples show that designers of welded structures should, more or less, follow the middle of the road, which can only be done if they have a true feeling for what a particular joint must withstand.

While much remains to be learned regarding structural behavior of dynamically loaded fabricated parts, certain types of welded joints can be evaluated and their quality controlled. But the cost of making full-size experimental stress analysis is generally prohibitive; this is true even more so for full-scale fatigue testing, except for those large companies that produce large quantities of identical products or parts and can bear the expense of equipment and testing. Cost of equipment and operating it limits this field of investigation to such companies.

Until more is known about structural properties under dynamic loading, designers must necessarily continue to apply the factor of safety. But this today is not sufficient for two reasons: first, fabricated structures are being designed to operate at increasingly higher stress levels, and second, elimination of notch effects in weldments is undesirable from the cost standpoint and limitation on design freedom.

The only remaining way of obtaining data of practical value is a careful, correlated study of failures to determine basic principles of the behavior of dynamically loaded structures.—Weld Eng, Mr, 36



DRIER ROLL was bulged during the hydrostatic test by an excess pressure but no fractures or weld failures occurred

ASPIRIN PROCESSING from raw materials to crystalline aspirin progresses (right to left) through reactor, primary suction filter, wash tank, secondary suction filter, tray dryer.

No Headaches Here

No problems in the new home for an old remedy because modern methods and finest equipment combine to eliminate all production difficulties

BEST SELLER FOR YEARS, aspirin is still No. 1 in volume of all medicinals. Bayer Co. Division, Sterling Drug Inc., now manufactures all Bayer aspirin in its new plant designed to handle complete processing as well as finishing and packaging.

The plant embodies every possible feature to insure purity, uniformity, and potency. Wide use of stainless steel—in reactors, filters, and all other equipment in contact with the product—aids in preventing contamination. Seventy control tests check product from raw material to finished tablet.

Air conditioning also plays a part in prevention of contamination and in safety. All entering air is scrubbed and filtered. In process buildings, a complete change of air is accomplished every 3½ min. to remove any noxious fumes that might be present. To check the ventilation system, a gas analyzer installed in each process building samples air at various critical locations and sounds an alarm if fume concentration approaches the lower explosive limit.

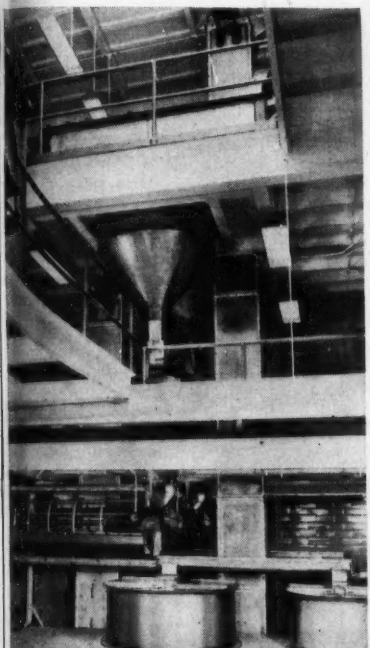
Aspirin (acetylsalicylic acid) is made from two basic raw materials, salicylic acid and acetic anhydride, plus other compounds including naphtha, benzol, caustic soda, and food starch.

Batch processing of aspirin crystals takes 4 days in a manufacturing unit composed of a water-jacketed reaction kettle, primary suction filter, slurry wash tank, secondary suction filter, and a tray dryer.

Measured quantities of salicylic acid, acetic anyhdride, and naphtha are charged into the reactor and brought to acetylation temperature by hot water circulated in the jacket. Acetylation is completed in 6 hr. and the vessel is cooled, first for 3 hr. by radiation, then by cold water through the jacket.

The slurry of aspirin crystals and mother liquor is blown by compressed inert gas to the primary suction filter. The mother liquor is here filtered off by vacuum to a receiver and the crystals are washed with a benzol spray.

Crystalline aspirin is transferred to a wash tank in which it is slurried with benzol. After several hours of agitation, the slurry is blown to the secondary filter where the wash liquor is drawn off and the filter cake rewashed with fresh benzol. Washed crystals are then dried for 24 hr. in tray dryers and discharged into drums to await tableting.



CRYSTALLINE ASPIRIN and starch, raised by bucket elevator to the ribbon mixer are blended, hopper fed to the attrition mill for pulverizing, and screened in a horizontal bolting reel before hopper-feeding on down to the tablet machine.

Processing into tablets is started by dumping carefully weighed amounts of aspirin crystals and starch into a bucket elevator that carries the mixture to a ribbon mixer. After blending, the mixture feeds to an attrition mill in which it is pulverized, then to a bolting reel to screen out large particles, and finally to a machine that compresses it into 90-grain slugs.

These slugs are transferred by bucket elevator and closed conveyor to an adjoining building. Here the slugs pass through an oscillating sieve pulverizer in which they are reduced to granular form. This is compressed to finished 5-grain tablets in a battery of machines. Tablets are aged, inspected, and automatically packaged. The double compression cycle provides tablets of greater uniformity than is possible with single compression.

Efficient processing calls for recovery of the naphtha and benzol. The mother liquor is blown from its receiver to a vertical separating tank and diluted with water. The naphtha separates out and is pumped to a neutralization tank in which any acid present is neutralized with caustic soda. This is allowed to settle, and the water layer containing neutral salts is drawn off and discarded.

The naphtha layer is passed through a Sparkler filter, distilled, condensed, and fed to a decanter in which water and naphtha are separated. The naphtha then passes through a dryer and is returned to storage.

Benzol wash-liquor is blown from its receiver direct to a neutralization tank where, as in naphtha recovery, the acid present is neutralized with caustic soda. Neutral salt water is separated out and discarded. The benzol layer goes through a Sparkler filter and is steam-distilled in a fractionator.

Benzol water, as the overhead product, is condensed, decanted, and dried. Bottoms from the fractionator contain some naphtha, so are sent to the neutralization tank of the naphtha recovery system.—Chem Eng, Mr, 96

RAYON, COTTON FABRICS HIGHLY FLAMMABLE

Rayon and cotton fabrics with extra long or fine nap are classed as highly flammable in tests conducted by Textile Chemists & Colorists and the National Bureau of Standards. Light nets and diaphanous materials are hazardous. Certain lightweight coated fabrics, such as those used for shower curtains, have resulted in serious fires.

Federal legislation, regulating shipment of highly combustible fabrics in interstate commerce, is expected. One state has passed legislation regulating manufacture and sale of highly combustible textiles; in other states, legislation is pending.—Textile World, Mr, 109

STORED-ENERGY DRIVE

Experimental electrogyro rail car, built by Ateliers de Construction Oerlikon, Zurich, is driven by energy stored in a flywheel. The flywheel is brought up to 3,000 rpm. in 1 min. by a pole-switchable, dc., short circuit-anker motor by connecting it to a normal low tension dc. source. During runs, the motor acts as a generator, delivering current to the driving motors.

A 10-ton vehicle having a 1-ton fly wheel can be driven 6-10 mi. on one charge. Suggested practical uses are in mine work where overhead lines may be dangerous and in passenger vehicle service where there are no grades and where frequent regular stops would allow recharging flywheel.—Prod Eng, Mr, 108

COMPUTES FLIGHT TIME

Pilot's flight time and flight scheduling data at Pan American Airways is now computed by an ingenious device designed by the pilot in charge of scheduling. Elapsed flight time of over 700 crews is figured by the 18 x 12-in. automobile speedometers. Time of departure of completed flight, time of return to base, and hours flown are cranked into device and machine tells the date, hour, and minute the crew next can be sent out. Flight time is broken down into both monthly and weekly figures.—Air Trans, Mr, 47

BRAKES OIL DRILL PIPE — Eddy-current brake, at extreme right in line with the hoisting-drum shaft, provides smooth deceleration of load and a decrease to a safe value in a short time. Acting on the solid brass rotor are four stationary field coils carrying dc. furnished by an electronic control using thyratron tubes. Two rectifier circuits prevent complete power failure. Lever movement first applies eddy-current brake, then the mechanical brake that holds the pipe stationary.—Electronics, Ap, 92

FLUORESCENTS GO UNDERGROUND—Mining coal by fluorescent lighting in pits of Chislet Colliery, Kent, England, may make the mines more popular. Fittings are fame-proof. If experiment is successful, all mines may be lighted by fluorescents.—Elec World, Mr 6, 17

TRENDS IN MATERIALS

The plastic-filler problem may be solved on the farm. A new molding compound, Plastone A, developed at the University of Tennessee, utilizes cottonseed hulls as a filler. Still another compound contains pecan shell flour.

Silicon rubber, molded into gaskets, finds a place between supercharger connections and each of 16 cylinders on the new General Electric-American Locomotive Co. diesel locomotive; latest outlet is an oil and air vapor seal on a jet engine.

New and better synthetic rubbers are being developed—over 400 variations of GR-S are in production. Two synthetics just announced are claimed to be superior for tire treads and carcasses.

Average new automobile has about 100 pieces of plastic weighing about 5 lb. Seven types are now used; future plans envision more nylon in upholstery, laminates replacing steel in some places.

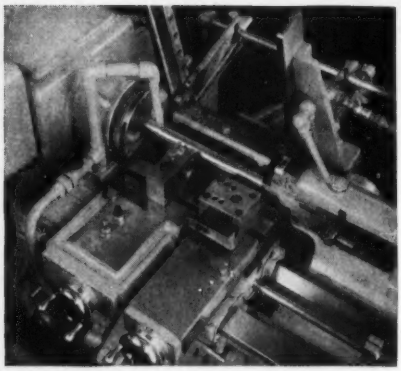
Arizan, Marvinol, Saran, Tygon, Geon, and Vinylite, coated to ¼ in. on workholder racks for plating, cut plating of holders to a minimum. Plexiglas now provides extra heat resistance for high-speed airplane blisters, auto visors, light shades, and machine guards.

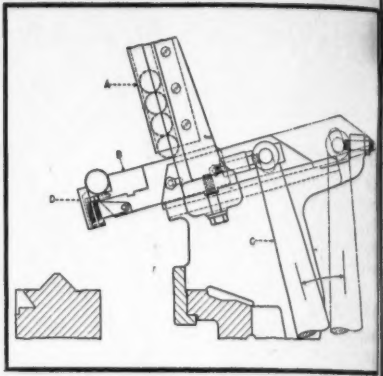
Stainless steel of high corrosion resistance, especially to sulphuric acid, is now available in wrought form from Carpenter Steel Co. Mechanical properties are about the same as 18-8 stainless. Result is that processing tanks for handling sulphuric acid can be made by forging or other relatively inexpensive forming methods.—Prod Eng, Mr, 104; Am Mach, Mr 11, 148

BORON HARDENS STEEL

Boron treatment, according to U. S. National Bureau of Standards, depends for effectiveness on steel-making practice and the amount and form of boron retained in the steel. Optimum effect is obtained when boron in the form of simple or complex ferro alloys is added to deoxidized heats in which recovered boron amounts to 0.001-0.005%.

Influence of boron on hardenability and notch toughness of hardened and tempered steels varied with base composition of steels, composition of intensifiers, and the amount of boron present. Hardenability increased with the amounts (within limits) of manganese, chromium, and molybdenum, and also varied with state of deoxidation of heat and final nitrogen content. Magnitude of hardening effect depends on form in which boron exists in austenite.—Weld Eng, Mr, 92





MECHANICAL WORK LOADING—Managements more and more appreciate the possibilities of cost cutting through mechanical loading and unloading of machine tools. Westinghouse is rough-turning motor shafts on an automatic lathe equipped with a work loader. Shafts from magazine A are moved by transfer slide B to forward position between lathe centers. Tailstock center moves in to grip the work, and slides are returned by a lever C when finger D releases its grip on motor shaft. Production is 35 to 50 pcs. per hr., as compared with 20 to 25 without loader.—Am Mach, Mr 11, 149

WILLYS-OVERLAND TO MAKE 6-CYLINDER JEEP SEDAN

Willys-Overland's Jeep station sedan will be powered by a 6-cylinder engine, the first 6-cylinder engine produced by the company since 1932. Similar in looks to the station wagon, it will have a solid color body with a cross-weave panel around the body. Grille differs slightly from the standard Jeep front end. Rated 21.6 hp., compression ratio is 6.5:1 with 148.44-in. displacement.—Am Auto, Mr, 60

RAISES ROT RESISTANCE

Partial acetylation of cotton fiber by new and rapid process gives fabric a high rot resistance. Developed by U. S. Dept. of Commerce, it converts part of the fiber to cellulose acetate, thereby increasing resistance against organisms causing mildew and other rot.

The treatment causes no discoloration, imparts no odor, and does not make cotton sticky or poisonous. Fabric and yarn can be acetylated.—Chem Eng, Mr, 76

PUMPS MATCH CONDITIONS

For low-head applications in which pumping requirements vary, adjustable-vane propeller pumps can meet changing operating conditions, such as static head, pumping demand, and suction supply. An axial-flow pump with an adjustable-vane impeller operating at constant speed is comparable to a centrifugal pump having a number of impellers that can be changed at will.

Impeller vanes are adjusted from a motorized gear head through a rod, lever, and a vertical vane-adjusting shaft below the pump. As the shaft moves up or down, it positions the vanes through a crank arrangement. Varying the impeller vane angles permits selection to suit a wide range of conditions with reduced pumping power and condenser maintenance.

As condenser-tube life varies inversely as the amount of water pumped through them, holding the quantity to an economical minimum is desirable.—Power, Mr, 92

High-Temperature Ceramics

New developments in ceramics are creating more and more interest as their applications for high-temperature equipment promise improved performance

HIGH-TEMPERATURE CERAMICS promise much for use as molded parts, refractory linings, and coatings for gas turbines, jet engines, rockets, and other equipment operating at elevated temperatures.

As power-plant thermal efficiencies can be increased if operating temperatures and compression ratios are raised, improved construction materials are necessary. Here, ceramics must be considered as an aid or substitute for metal because of their high corrosion resistance, insulating characteristics, and erosion resistance.

They may be applied as paints, coatings, and in solid form. In paints, they protect large metal surfaces exposed to temperatures not over 1800° F. by reducing radiant energy transmission and oxidation.

Ceramic coatings, fired on, protect the base metal at temperatures within its plastic range. The three types of coatings are graphites and carbons, oxides, and endothermic materials.

The first are mixtures of graphite and metal powders, fire-polished to oxidize the metal near the surface and to fuse the oxide to a continuous film. The second are metal oxides as calcined magnesia, and the third are materials, such as a plaster-graphite mixture, that decompose endothermically at high temperatures.

Solid ceramics are cast, sintered, or transfer-molded. Good physical properties are retained at temperatures up to 2000-5500° F. Ceramics showing excellent promise are: fused beryllia, zirconia, and alumina; metallic oxides bonded with metals; carbides, nitrides and, borides bonded with metals; and glazed and bonded graphite and carbons.

Basic characteristic of all ceramics is their brittleness, but they become more ductile at elevated temperatures. Most ceramics creep under sustained loading, beginning at about 1600° F. Thermal-shock data is generally unavailable, but ceramics loose strength when exposed to temperature cycling. Exceptions are metallic oxides to which silicon carbide has been added.

High-temperature ceramic production is small. Manufacturing involves preparation of the ceramic material and fir-

LOOKS THROUGH METAL—That's a sheet of metal the young lady is looking through. It's one ten-millionth in. thick. Case Institute of Technology researchers made the sheet during studies of magnetic properties and crystalline structures of metal film.—Business Wk, Mr 13, 44

ing, during which the body shrinks up to 20%. Methods in use are: compacting and sintering, slip casting, transfer molding, and hydrostatic molding. Selection of method depends on type of ceramic, quantity, size, and cost.

Design of ceramic parts should avoid stress raisers because of low ductility and allow some degree of freedom to prevent restraints. On coated parts, the dimensions of the bare pieces should allow for variation in coating thickness, such as at sharp corners. Recognizing the present physical deficiencies of ceramics permits the engineer to avoid designs that amplify those properties.—Prod Eng, Mr, 110

BETTERS BEAN QUALITY

Quick cleaning and speedy handling of lima beans are more important to quality than quick cooking according to Dr. M. A. Joslyn, University of California. Beans vined late in the day were dry-cleaned, washed, and held in ice water for 16 hr. before processing the next day. Quick cleaning controlled enzymic reaction from viner juice, while ice-water temperature reduced respiration.—Food Ind, Mr, W 18

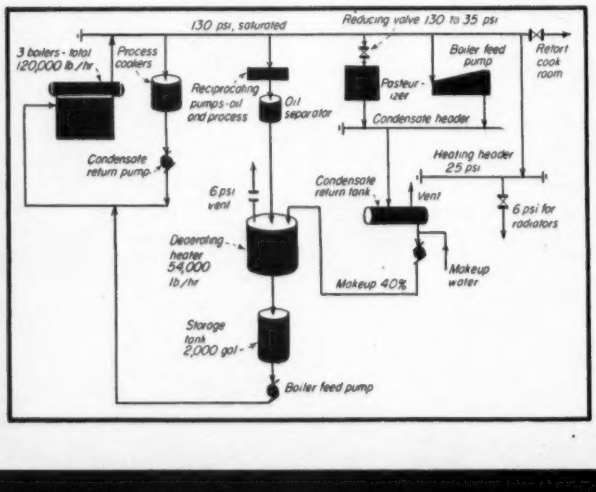
PRODUCTION WALL CHARTS CUT WRITTEN REPORT 75%

Three wall charts—machine-load board, master-scheduling board, and cost-control board—have eliminated 75% of the reports previously written by Hydro-Power, Inc. One girl takes care of all three boards.

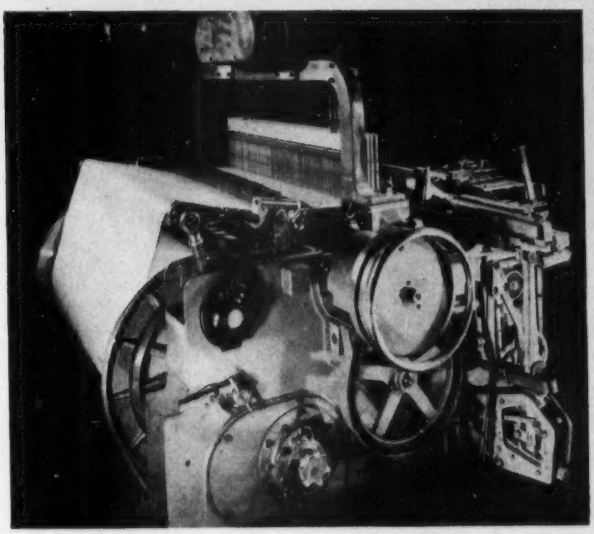
Machine-load board lists all machines in the left vertical column. Horizontally across the top are six weekly columns. In these columns, opposite machine numbers, are hung cards giving order number, number of pieces ordered, and estimated time machine will be tied up. Quickly machine loads and back-logs can be determined; one man can supply stock to all machines after a visit to the board.

Master-scheduling board lists orders by delivery date. Colored cards, hung in proper column, reflect all pertinent information on each order. When order is completed, card is removed and successive orders are moved up.

Cost-control board shows each operation performed on each part, including set-up hours and machine time. If set-up time is greater than estimated, a red card is hung up; green card indicates estimated time is within 20% of actual



POSITIVE CONDENSATE RETURN— Process-steam demand in a cannery can vary widely, and losses run high. At E. Pritchard, Inc., losses from draining condensate from catsup cookers to atmosphere at 212° F. have been eliminated by installing two parallel-connected condensate removal pumps that return water direct to the boiler at 360° F. Result: cooking time cut from 15 to 7 min. and fuel saved.—Oper Eng, Mr, 36



NEW HIGH-SPEED LOOM — Rated 40% faster than conventional looms, this new M. W. Kellogg Co. loom is now in production in 40- and 60-in. widths. Controls are electric. It is assembled on a unit system to speed assembly and lower downtime in the mill.—Business Wk, Mr 20, 60

set-up time; yellow card indicates a saving of more than 20% of estimated set-up time. Cost-control section can determine which operators are responsible for the additional set-up time changes, thus chart gives a good index of each operator's performance.—Factory, Mr, 126

ARITHMETIC MADE EASY

Long routine calculations often hamper engineers and designers. But high-speed electronic computers can solve this problem. The two types—digital and analog—have each its own useful field.

While digital computers give higher accuracy and can perform more complex operations, analog computers are easier to build and set up. The latter can replace engineers' slide rules, being faster and having about the same accuracy.

They are ideally suited to computations too expensive to be undertaken manually. They solve complicated systems of differential equations by using such simple circuits as dc. amplifiers and potentiometers.—Electronics, Ap, 122

RENEW UNDERGROUND COAL-BURNING TESTS

U. S. Bureau of Mines and Alabama Power Co. will continue experiments in underground gasification of coal. Previous tests (See McG-H Digest, Oct. '47, p. 13) yielded 50-Btu. gas. New tests will be carried out in a 30-in. seam, too thin to be mined. It is overlaid by 100-125 ft. of earth. High air pressure, supplied by two turbo-compressors, will be used. It is hoped that 150-Btu. gas will be obtained.

A line of vertical shafts will be drilled down to seam; shafts first will be connected by a horizontal shaft cut through the seam. Fires will be started in the coal at the bottom and between vertical shafts. Air under pressure will be forced down one set of shafts; gas will be drawn off the other set. As fire progresses, secondary shafts will be drilled ahead of burn area.

Periodic quenching with steam should double Btu. value. Gas is hoped for.—Business Wk, F 28, 35

Radiochemical Lab Safety

Contamination, health hazards in "hot" laboratories handling beta and gamma activities determine their design for safe, efficient operation

RADIOISOTOPE HANDLING demands certain requirements in design, operation, and administration of a radioactivity laboratory if health hazards and laboratory contamination are to be kept at a minimum. Type of radioisotope must be considered, because contamination is a function of the half-life while health hazard depends on the amount and energy of the activity present.

The first important administrative rule for a "hot" laboratory is delegation of authority and responsibility to one person for the activity stored and in use. Complete records must be kept.

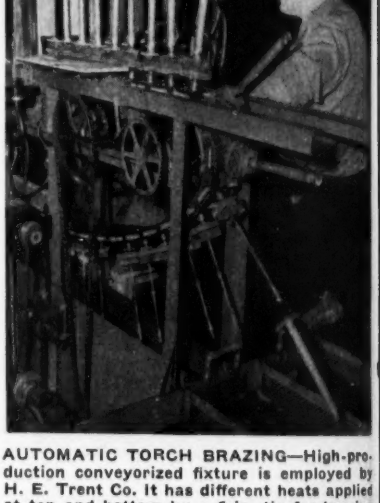
Personnel must be chosen carefully, as one careless worker can endanger the entire staff. Workers should be rotated to share the hot work and should be given an easily understood set of rules. Physical examinations should include blood smear tests to determine if the smear picture deviates from normal and be followed by quarterly tests unless over-exposure is suspected.

Lab rules should specify that in no instance should radioisotopes be processed in a room used for radioassay work because of the orders of magnitude of the activities involved. There must be no easy and direct access to or between the counting room and hot lab. Working surfaces may be stainless steel, which can be washed with water or acid, or a porous material, such as Masonite or Transite, which is discarded when contaminated. Ventilating hoods are desirable.

Workers should wear rubber gloves when handling activity samples. With high-activity samples, remote handling tools are essential. These are made of stainless steel, the safest type being one in which the sample is held within a metal container that is part of the tool. Distance is important as a protection from radiation hazards.

An essential rule that should be enforced is that no radioactivity experimentation should be carried out until dummy runs, complete in every detail, are made with nonradioactive materials.

Surveying and monitoring problems include: (1) Continuous record of radiation exposure of workers, (2) radiation measurement of order of magnitude of



AUTOMATIC TORCH BRAZING—High-production conveyorized fixture is employed by H. E. Trent Co. It has different heats applied at top and bottom by a 6-in. tip for brazing in a copper closure plug with preplaced alloy and a 12-in. multiflame for brazing 1-in. O.D. by 10-in. long copper tube to a cast brass base. Fixture bases are gear-and-rack driven to rotate parts as they pass by the tips. Results of automatic equipment: production doubled, rejects reduced by 60%.—Weld Eng, Mr, 42

tolerance dosage, and (3) checking of contamination of a low order of magnitude. Personnel monitoring can be done satisfactorily by a film badge which shows the total amount of exposure over a given period as a week. Also, workers should be monitored whenever leaving a hot lab.

All equipment should be monitored before starting any new experiment and at regular intervals. If contamination is found, the equipment should be cleaned if possible, otherwise discarded or stored until the contaminant has decayed to a negligible value.—Nucleonics, Mr, 1

EMERGENCY CHLORINATOR HANDLES TEMPORARY JOBS

Commercial chlorinators are not easy to move when emergencies demand water chlorination. Besides, their installation is too expensive for temporary jobs.

Such jobs are easily handled by a quickly built aspirator-type chlorinator having a vacuum breaker on the supply line between a chlorine cylinder and the aspirator. Gas is drawn from the cylinder by suction created by water pressure in the aspirator. Chlorine mixes with the aspirator water and is carried into the water supply.

A water pressure of about 50 psi. is needed at the aspirator, and more if the aspirator discharges against any appreciable pressure. The gas flow can be judged fairly closely if the cylinder is placed on a platform scale and the loss in weight is timed. Flow should not be made great enough to lose vacuum at the vacuum breaker.—Oper Eng, Mr, 31

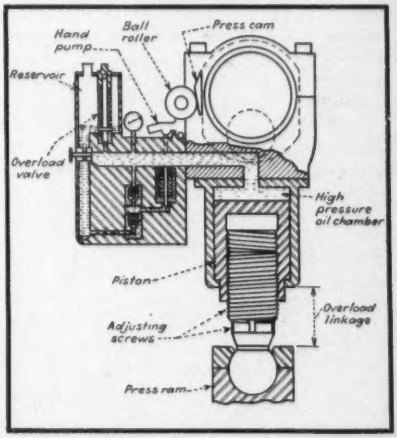
WEATHERPROOF WHITE FIR

Experiments in weatherproofing white fir shingles at the University of Washington may make white fir shingles equal in properties to cedar shingles at lower cost. Shingles are treated with methylol urea in combination with other chemicals.—Business Wk, Mr, 20, 68

NEW DUCTS UP ENGINE HP.

New air ducting system, designed by Lockheed Aircraft Corp. for use on *Constitutions*, has raised engine takeoff power by 200 hp. per engine. The ducting now bypasses the normal induction system for takeoff so ram air travels only 8 in., through one bend, to carburetor.

Also aiding in increasing horsepower is an exhaust collector ring butterfly valve opening in takeoff to permit engine to exhaust directly to outside over wing surface. At 89% of designed gross weight, plane was airborne after a run of only 1,503 ft. with the new system.—Aviation Wk, Mr 8, 29



PREVENTS PRESS DAMAGE—Replacing punch-press connecting rod with a telescoping hydraulic assembly avoids overload damage to cranks and frames. If preset working pressure of ram is exceeded, the piston moves in the high-pressure oil chamber, permitting the rod to shorten as oil escapes to the reservoir. Hand pump reestablishes high chamber pressure, and the ball roller, actuated from the press cam, maintains a constant chamber pressure. The overload jack, made by Dayton Rogers Mfg. Co., can be calibrated at maximum press capacity or to protect the dies. Available in sizes from 25 to 500-ton capacity, it can be installed on single- or double-crank presses.—Prod Eng, Mr, 95

CUCUMBERS CLEANED BY GERMICIDAL SOLUTION

Spoilage reduction and quality improvement of pasteurized pickles stem from precleaning with a quaternary ammonium detergent germicide. Aerobic, spore-forming microorganisms are decreased from total of 11,500,000 per cc. before washing to 3,000 with a germicidal wash, as compared with 60,000 when washing is done with tap water.

Germicidal solution, at a concentration of 1 oz. to 5 gal. of water, is held at 100-110° F. Cucumbers are submerged for about 3 min., then transferred to a rotary washer for removal of germicide and adhering dirt by high-pressure water spray. Periodic replenishment of germicide is advisable plus a complete change every 4 hr. because of accumulated sand and dirt.

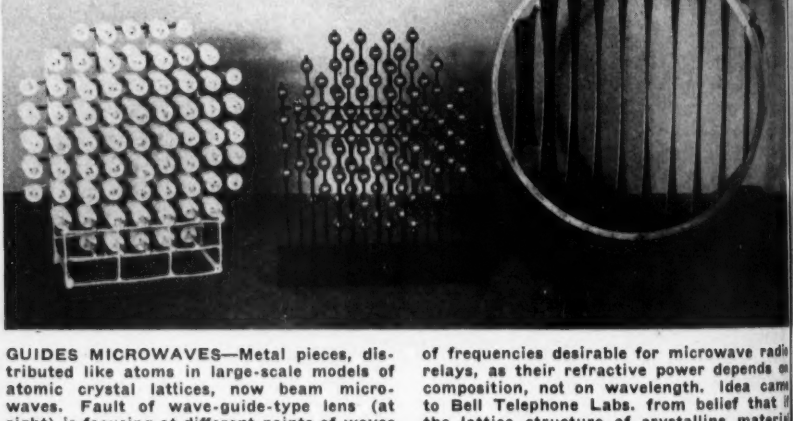
Used commercially for washing dirty shell eggs and equipment in wineries, this germicide, known as Emulsept, not only improves quality. It also reduces processing costs by cutting pasteurization time to 15 min. from the usual 20 min. Its free-rinsing properties make complete removal possible by water spray.—Food Ind, Mr, 80

NEW TRUCK DEVELOPMENTS

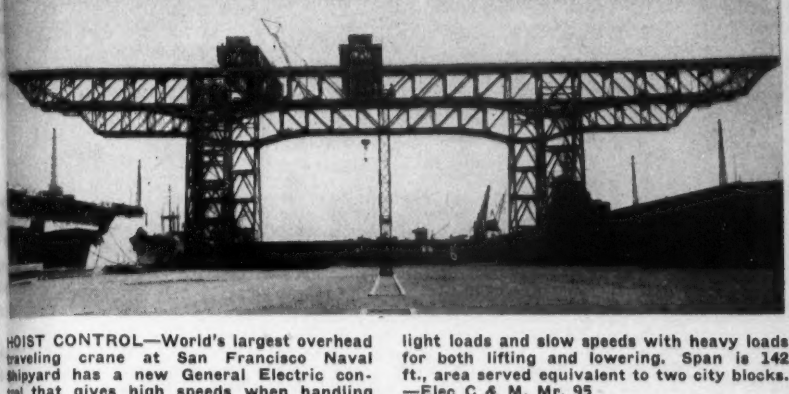
Dodge, Fargo, and DeSoto trucks, comprising 248 basic chassis designs, have adopted cross steering, permitting 37° turning both right and left. Road shock through steering column is reduced greatly, and parking and backing are simpler.

Models from 4,850- to 23,000-lb. gross vehicle weight and up to 40,000-lb. gross train weight are available.

Chevrolet has announced its first forward control delivery truck. Synchro-mesh gears for four forward speed heavy-duty transmissions now have helically cut gears to reduce noise and ease control.—Am Auto, Mr, 59



GUIDES MICROWAVES—Metal pieces, distributed like atoms in large-scale models of atomic crystal lattices, now beam microwaves. Fault of wave-guide-type lens (at right) is focusing at different points of waves having different wavelengths plus narrow band-width focused. The dielectric lenses (left and center) can focus over a wide band of frequencies desirable for microwave radio relays, as their refractive power depends on composition, not on wavelength. Idea came to Bell Telephone Labs. from belief that if the lattice structure of crystalline materials can focus light waves, a scaled-up model should also focus electromagnetic waves of scaled-up wavelength.—Electronics, Ap, 10



HOIST CONTROL—World's largest overhead traveling crane at San Francisco Naval shipyard has a new General Electric control that gives high speeds when handling light loads and slow speeds with heavy loads for both lifting and lowering. Span is 142 ft., area served equivalent to two city blocks. —Elec C & M, Mr, 95

NEW SYNTHETIC FOR TIRES

Ultipara, a new synthetic rubber for automobile tires, has been developed by Copolymer Corp. Tests by the company show the new synthetic to be 20% better than the natural product. Butadiene and styrene are mixed at temperatures about 40°F., compared to 122–125°F. for GR-S. The new synthetic contains the same basic ingredients as the better known GR-S.

The synthetic both feels and stretches like natural rubber; it can be made as cheaply as other synthetic rubbers. Having high ruggedness, it is especially good for treads since it is resistant to both cracking and abrasion.—Business Wk, F 21, 26

MEDICAL DEVELOPMENT

Two new treatments for plutonium poisoning show promise. One is to replace radioactive plutonium in an organism by zirconium, so the plutonium can be eliminated from the body, thereby reducing radioactivity.

The second treatment may be combined with the first. Plutonium poisoning causes death by breaking down the walls of veins and arteries, bringing internal hemorrhage. Rutin, the flavonol glucoside extracted from buckwheat plant, can prevent hemorrhage by strengthening these walls and might prolong life long enough for zirconium to do its work. Rutin also may prove useful in treating high blood pressure by reducing fragility and permeability of capillaries.

Chloromycetin will be given extensive tests this spring in Malay States by U. S. Army Medical Dept. The foe is scrub typhus. Drug is regarded as first one effective against rickettsial diseases, of which typhus is one.—Chem Eng, Mr, 76

PLASTIC EARDRUMS

A small plastic tube made of korogel, a rubber-like plastic possessing a low melting point, has been used successfully by Audiometric Laboratory to replace eardrums in 500 patients. The artificial eardrum, inserted to touch the stirrup bone, concentrates and funnels sound vibrations inward to permit patient to hear. Tubes vary from ⅛ to almost ½ in. dia.—Science Ill, Mr, 30

Greyhound Line's Highway Traveler, accommodating 50 passengers, is only slightly higher than conventional buses. It offers many conveniences not possible in standard buses.

50-Passenger Greyhound

New Highway Traveler to offer passengers comfort impossible in most buses. Equipped with two 150-hp. engines, one can power bus in normal driving

GREYHOUND CORP.'s Highway Traveler, one experimental model now undergoing highway tests, will accommodate 50 passengers in three compartments as against 37 in its current models. It is powered by two engines, each rated at 150 hp. one engine being capable of powering the vehicle.

The three passenger compartments cut floor space one-third. The Fore Lounge, reached by an inner stairway, houses the driver and 6 passengers in a non-glare forward dome. The Terrace Lounge, directly behind the Fore Lounge, accommodates 31. The two are reached by separate stairways. The Sedan Lounge, seating 13, is entered from the ground by a low, single step.

The new bus will have a drinking fountain, refrigerated cabinet, washroom, and toilet on the Sedan Lounge level. These facilities will tend to minimize lost running time now due to meal and restroom stops.

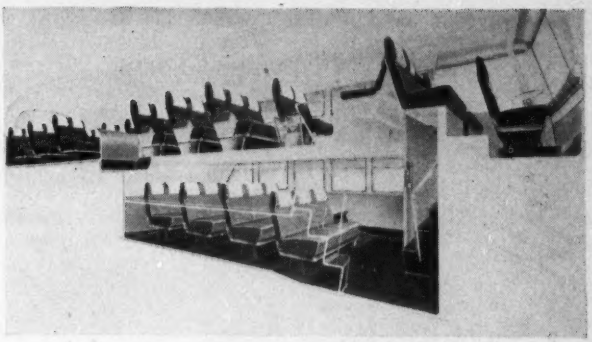
Power is from two air-cooled, 6-cylinder, horizontal-type engines mounted in the rear. It is the first bus to adopt horizontal, air-cooled engines. Under normal operating conditions, one engine will propel the bus, the second engine operating the accessories—air conditioning, generators, air-spring compressors, and power hydraulic units. On grades or whenever extra power is needed, the second engine cuts in automatically with no shifting of gears. In event of mechanical failure of one engine, the second will minimize road delay.

Both engines are suspended in rubber from special hangers. Either or both are easily demounted, cutting out-of-service time.

The body—only a few inches higher than current models—is mounted on air-spring cylinders, two at front and four at rear. The springs, together with rubber Torsilastic springs mounted on outside edges of body, promote excellent riding qualities.

Special metals and lightweight alloys have been used widely to cut weight. Semi-monocoque design reduces weight through elimination of chassis. Tires are lighter but stronger, wheels and hubs are aluminum.

Body frame members serve as air-circulation ducts. This eliminates weighty ducting and permits heating or cooling



Two levels in three compartments, 50 passengers sit in one-third the floor space of its 37-passenger predecessor. Two stairways to upper level are forward on the lower level.

of floors and walls in extreme weather. Windows are 50% larger than those in present models.

One important safety feature is an automatic steering gear control which prevents any blow to the wheels from deflecting bus.—Bus Trans, Mr, 46

WHY STEAM TURBINES NEED STANDARDIZATION

Standardization of industrial steam turbines is not impossible. Neither is it imminent today, but now is the time to make a start in this direction. It will not mean mass production, but standardization will permit repetitive manufacture. It will reduce engineering and production time and, most important, the capital investment required in a power plant.

The problem is not simple. The chief hope lies in new power plants where engineers have some latitude in choice of rated output, permitting a change from the present multiplicity of variables to a relatively few number. Suggested are reductions from the present 12 standard rating to 3, from 7 main steam pressures to 3, from 4 basic air-cooler types to 1, and also in voltages and other electrical characteristics.

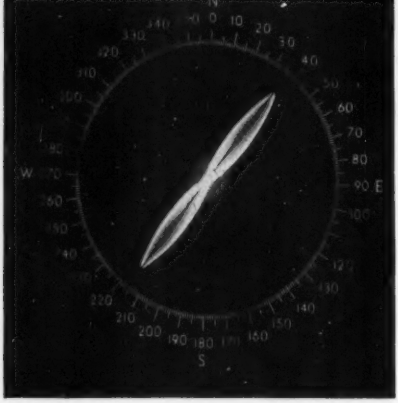
Chief obstacles are dissimilarity of users' businesses and little incentive for the user unless over-all power-plant costs can be reduced.—Power, Mr, 73

AIDS TRAINING PROGRAM

Since training of full-fashion knitting personnel normally takes 1 to 2 yr. and training of improperly adapted personnel is expensive, Shannon Hosiery Mills is using four standard aptitude tests in addition to forms and interviews for employee selection. Efficiency standard of new employees should be raised; poorly placed old employees will be spotted and means of improving their standards will be indicated; money will be saved through elimination of training of misfits.

Using a Bausch & Lomb ortho-roter, 20–25% of all applicants are failed on eye defects. Many old employees were helped when need for glasses was established. Manual dexterity and mechanical aptitude is checked by a block test. Block is cut into nine sections. Time required to reassemble block is checked. About 10% of the applicants fail this. A second dexterity test consists of placing 150 $\frac{1}{4}$ in. dia., 1-in. long wire pins vertically in holes in a board, using tweezers. Average time is 8 min., men proved more dexterous than women. A block manipulation test checks the applicants' ability to use both hands simultaneously and separately.

Basis for passing scores was determined from results of tests given to old employees with previous training.—Textile World, F, 143



Propeller-shaped pattern indicates direction but has 180° ambiguity, showing direct and reciprocal bearings.

DIRECTION FINDER GIVES INSTANT BEARING READING

Radio direction finding, although obscured by radar publicity, was advanced materially by wartime research. Improvements will be useful in monitoring and administrative control of aircraft flights, rescue operations, and location of illicit transmitters.

Operation of new U. S. Signal Corps finders is as simple as tuning a radio receiver. The desired signal is tuned in and a propeller-shaped indicating pattern appears on the indicator screen of a cathode-ray tube phasemeter.

Pattern tips indicate the direct and reciprocal bearings against an azimuth scale on the screen. Pressing a sense switch produces a folded pattern that arrow-like points to the direct bearing. High sensitivity depends on the electronic goniometer made up of antenna, balanced modulators, and a combining impedance. All moving mechanical parts have been eliminated.

For aircraft navigation, several direction finders are operated on base-lines and position fixes on transmitters are found by triangulation. Observed bearings are relayed to a central point for plotting. In aircraft homing, a reciprocal bearing is relayed to the aircraft. —Electronics, Ap, 86-

NEW GUM FOR SOFT DRINKS

Linseed oil meal cake offers a cheap source of a new colloidal gum belonging to the class of vegetable mucilages. Valuable properties of the gum as an emulsifying agent and thickener should give it a place in the food industry.

Suggested uses are in soft drinks, candy, jelly, ice-cream mixes, processed cheeses, salad dressings, and even in chocolate milk. Other probable applications are in textile, cosmetic, printing, pharmaceutical and cigar industries.

Linseed oil meal cake, the residue of flax seed after it has been pressed to extract oil, is added to a salt solution at 60° C. Extraction continues under slow agitation for about 20 to 30 min., and the mixture is allowed to settle. The supernatant fluid containing the gum is decanted, centrifuged, concentrated, and mixed with alcohol to precipitate the gum. Its absorption value runs from 1,500 to 2,500 and its viscosity of a 1% solution from 1.8 to 2.0 centipoises at 25° C.—Food Ind, Mr, 112

CHEAP COAL SYNTHESIS

A new, cheap method for low-temperature distillation of low-grade coal yields crude oil, gas, a high-grade smokeless fuel, and coal tar. Low-grade coal, costing about $8 per ton, is placed in a sheet-steel retort lined with rockwool. Steam at 1100° F. is forced into retort, the gas, oil, and tar being forced off leaving the smokeless coal as residue. The coal is said to be 20% higher in heat value than the raw coal used.

Sale of smokeless coal will pay for process costs, the byproducts being profit. —Business Wk, F 28, 38

DOING THE IMPOSSIBLE THE ELECTRONIC WAY

Electronic devices are almost human in their capabilities. No job is too complicated, too fast, or too precise for electron tubes. They control machinery, ring alarms, count parts ranging in size from tiny ball bearings to automobiles, match colors, measure star temperatures.

They detect the presence of things no one can see, gases no human nose can smell, motions no fingers can feel, sensations no tongue can taste. They serve as the electronic brain for radio, television, and other industry. They melt metals, vulcanize rubber, kill insects.

Uncanny in their ability to do jobs long considered impossible, electronic devices now can measure the thickness of walls of pipes and tanks from the outside. Gamma rays from a radioactive source are directed through the metal. Some are scattered back by the electrons of the atoms in the metal, so they emerge from the same side as they entered. Measuring the intensity of the back-scattered radiation indicates thickness of the material with extreme accuracy. Steel or iron walls can be measured up to 1 in., aluminum up to 1 in.

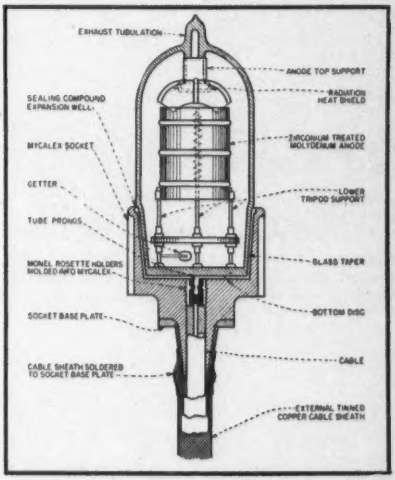
Seeing the invisible too is no longer impossible. Commercial applications of phototubes now detect foreign ingredients in our foods and drinks. In an automatic beverage-inspection machine, several phototubes are mounted on a chain driven by teeth on the outside edge of a turret carrying filled bottles. As the turret revolves, the teeth engage the chain so bottles travel in synchronized relationship with individual tubes for the necessary inspection interval.

The bottle is first spun at a high speed so the contents spin and continue to whirl rapidly when the bottle is stopped for inspection. As the bottle is aligned with the tube, a light beam from a lamp passes through the whirling contents. If the beam is interrupted by a foreign particle in the bottle, the change is detected by the tube and the bottle rejected.

As the bottle is standing still for inspection, imperfections or lettering in the glass cause no changes of light and have no effect on the selector mechanism that knocks out dirty bottles.—*From "What Electronics Does", McGraw-Hill Book Co.*

GIVES SOFTER LET-DOWN

New landing gear, now standard equipment on Luscombe Silvaires, gives three points for shock absorption resulting in softer let-down. The new gear comprises a tubular steel leg with a combination coil spring oleo unit. Snubbing action is provided by the oleo, which also reduces tire wear.—Aviation Wk, Mr 22, 27

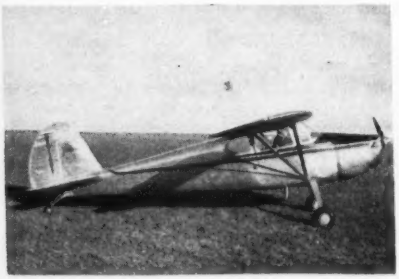


HIGH-ALTITUDE TUBE—Designed to operate with full rating at 60,000 ft., where the pressure is about 2 in. of mercury and temperature is —55° F., a new rectifier tube improves electronic control of guided missiles and jet-propelled airplanes. Secret is to exclude air from around base pins by an air-tight fit in a molded socket. The cable to the socket terminals is bonded to the socket, so at no point can air enter the system. Possible industrial applications will be in dusty conditions.—Electronics, Ap, 95

New Plans of

Aviation development during that year co supersonics and helicopters. Ne nces wer craft, with the U. S. Army and ordering c jet propulsion as well as planes reciprocatin now flying jets off aircraft car Also in m famed B-29's successor, the B peared d helicopters have been certified are now in the first 'copter transport being construc the transport field, but still on ing board The year saw United States al plane 16,023 planes, most of them ically. are from Aviation Week's "1 nual Ye

BEECH TWIN-QUAD—Powered by four Lycoming 375-hp. engines, two in each nacelle, it has top speed of 230 mph., cruising speed of 180. It carries 22-23 persons. Wings are 70 ft., length 53 ft.



CESSNA—170—In production in March, this 2-place personal plane has a gross weight of 22,000 lb. Engine, 145-hp., develops a 125-mph. speed. Price, $5,500.

GRUMMAN F9F-2—A single Rolls-Royce engine, developing over 5,000 lb. thrust, pushes this carrier-based fighter at speeds over 600 mph.

SIKORSKY S-52—Three 32-ft. rotor blades and 165-hp. engine give this 2-place 'copter a top speed of 97 mph. Celing is 13,500 ft.

CONVAIR-LINER—Formerly the 240, it carries 44 persons 800 mi. at speeds up to 336 mph. Cruising speed is 300 mph.

ns of 1947

t year centered in two fields—
Nonances were made in jet-propelled
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ciprocating engines. The Navy is
Also in military planes, the war-
B- peared during the year. Three
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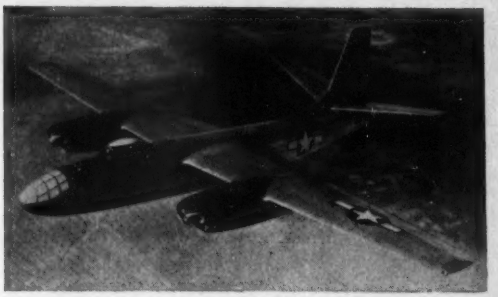
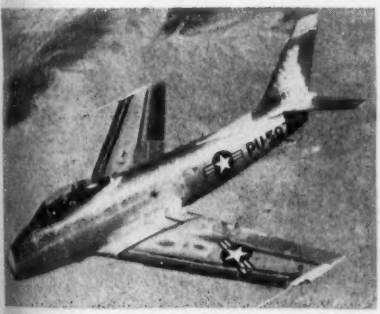


BOEING B-45—Now being used by the U. S. Army, this is the first jet-propelled bomber in service. Range is over 1,600 miles, with speeds in excess of 500 mph. Four jets develop 4,000 lb. thrust.

BOEING STRATOCRUISER—To carry 57-85 passengers, this transport was certified in 1947. Its gross weight is 135,000 lb.; empty, 79,000; cruises 340 mph.

LUSCOMBE SILVAIRE SEDAN — Selling just under $7,000, this 164-hp. plane has cruising speed of 130 mph. Range is 500 miles. Wing span is 38 ft.



NORTH AMERICAN P-86—Speeds of over 480 mph. are generated by its 4,000-lb. thrust engine. Range is 1,000 mi. It is 37 ft. long.

PIASECKI HRP-1—First transport-type helicopter built. Several are on order for the Navy. Top speed is 100 mph.; range 300 miles.

TECHNICAL SHORTS

Aluminum Cap Defies Lightning—Watthour meters have given much trouble in running fast because of demagnetizing effects of lightning surges on the damping circuits. A cylindrical aluminum shield that slips under the glass meter cover eliminates the trouble at little cost. Currents induced in the shield by surge currents create an opposing field to neutralize that part of the surge field affecting the meter.—Elec World, F 28, 67

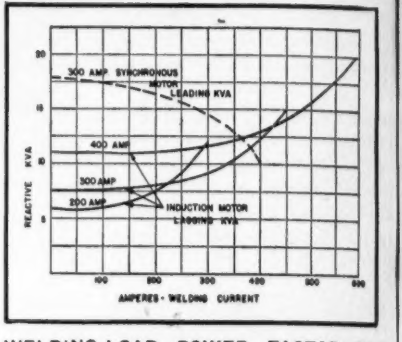
Raise Factory Health, Morale—Goodyear Tire & Rubber Co. set up a free slenderizing salon for women workers to raise health standards and improve morale. Over 100 women use the salon. . . . At Fulton Bag & Cotton Mills, the company foot clinic has reduced absenteeism 12%. Foot trouble had long been a cause of hookey-playing.—Business Wk, Mr 6, 26

Takes Night Aerial Pictures—Night photo reconnaissance will be possible at altitudes as low as 900 ft. and up to 2,000 ft. with a new camera under test at March Field, Calif. Flash unit is installed in bomb bay, flash being such that it is almost undetectable from the ground.—Aviation Wk, F 23, 18

Starch, Wax from Sorghum—Wet milling sorghum grains for the recovery and purification of starch by a modified process is being done at Kansas State College. Starch extracted from sorghum grains is used in baked goods, syrup, dextrose, paper, insecticides, and adhesives. Wax is a byproduct from the wet milling, 1 lb. of wax being recovered from 400 lb. of sorghum.—Food Ind, F, 143

Plastic-steel Firewall—New paneling for airplane firewalls protects human flesh within 1 in. of fire at 2200°F. The lightweight panels are constructed of specially treated cellular cellulose acetate plastic sandwiched between sheets of 0.006-in. carbon steel.—Chem Eng, F, 80

Low-voltage Radiant Heat—Radiant heating through low-voltage, high-current power in a ½-in. plow-steel cable in house construction in California costs 70¢ per sq. ft. of house area. Heating cost is estimated at 15-22¢ per hr. A 4-in. concrete slab is covered by fiber board, the cable being stapled to it. Then a 2-in. cover slab is poured.—Eng News-Rec, F 19, 94



WELDING-LOAD POWER FACTOR—Reduction of power factor by induction-motor-driven welding sets can be corrected by adding synchronous-motor-driven welders. As a 300-amp. induction-motor set draws about 8 lagging kva. from the line, one 300-amp. synchronous-motor set, which draws about 17 leading reactive kva., would compensate for the lagging reactive kva. of two induction-motor sets and bring power factor to near unity.—Weld Eng, Mr, 58

Sterile Machines—Pharmaceutical machinery must be kept sterile, demanding metals that will not contaminate liquids or solids and almost banning lubricants. One designer uses stainless steel exclusively, finds one particular alloy hard enough so cams and ways can operate dry. He also replaced solenoid controls with 24-volt motors.—Am Mach, Mr 11, 148

Lands Plane Passengers—For use in emergency landings of DC-4's and DC-6's when steps are unavailable, American Airlines is using a vinyl-coated Fiberglas chute. Chute is attached by quick-attach fasteners to door frame; two passengers slide down ditching ropes, then hold chute out at bottom. Using the 90-in. by 22-ft. chute, plane can be emptied in 3 min.—Air Trans, Mr, 23

Use Long-draft Spinning—Processing of worsted yarns from tops on modified cotton-type long-draft machinery is underway at Coosa Valley Mills, Inc. From gill boxes stock runs through modified drawing, roving, and spinning frames before it is packaged for shipment.—Textile World, Mr, 120

Hot Water, Not Steam—Use of high-temperature, high-pressure water instead of steam for process heating is gaining in popularity. Right now, fuel-short Australia is enthusiastic about possible savings. Two textile mills in Victoria have installed hot-water plants. Temperatures are up to 350° F. at 120 psi. More heat can be transmitted per unit volume than with steam, and fuel savings as high as 30% are claimed.—Power, Mr, 94

Keeps Paver Aligned—A 6-ft. steel channel mounted on operator's side of a self-propelled asphaltic concrete paver keeps paver aligned. A pointer—length adjusted by set screw—at the end of the channel follows chalk line as unit advances.—Eng News-Rec, Mr 4, 94

Figures Cargo Bulk—To permit air line freight employees to compute quickly and accurately freight cubage, a United Air Lines cargo man has developed a "cube stick." With it, shippers can arrive at an accurate cube measure by reference to a logarithmic scale on stick.—Aviation Wk, Mr 15, 46

Keeps Rock Drills Fit—A small hole drilled in the exhaust port of a drifter which directs a continuous air jet against feed screw will prevent rock dust from collecting on lubricated surface of feed screw on drifters. Oil picked up by air jet aids in lubrication of the feed screw according to Homestead Mining Co.—Coal Age, Mr, 94

Protects Freight Handlers—A collapsible, portable steel frame and dock at Personal Products Corp. protects freight handlers during bad weather. When freight car is spotted, dock is wheeled into position giving workmen a covered arch to work through.—Factory, Mr, 134

Cheese Keeps Better—Australian investigations show that Cheddar cheese made from homogenized milk keeps better under tropical conditions. No fat is exuded at temperatures over 100° F. Also, cheese yield per pound of butterfat is increased and fat losses in the whey are lower.—Food Ind, Mr, 101

Light Auto Wheel—Kaiser-Frazer Corp. engineers have developed a magnesium auto wheel weighing 8 lb. Conventional steel wheels weigh 19½ lb. Next light metal project for K-F engineers is an aluminum car door.—Business Wk, Mr 13, 40

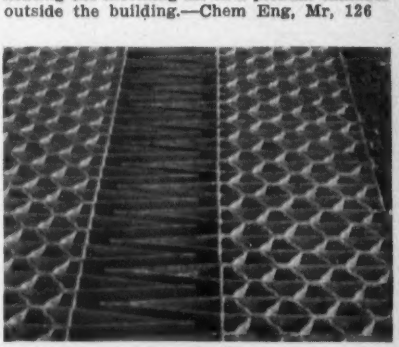
Light Fattens Pigs Faster—Pigs, like hens, evidently benefit from a longer work day. U. S. farmer, who leaves lights on in the hog barn all night, finds shoats gain ½ lb. every 24 hr. because they feed at night.—Elec World, Mr 12, 140

Still Cost Conscious—Purchasing officials of a large U. S. firm are teaming up with production and design engineering staffs to review each company product, part by part, to agree on satisfactory substitute materials and on economies in manufacturing techniques. Cost of one product has already been reduced 20%.—Am Mach, Mr 11, 121

Concrete Utility Pole—Scarcity of steel and short life of wood poles encourage extensive use of reinforced-concrete poles in Mexico. Poles are cast in a tapered trough and cored by a steel-covered wooden mandrel. Reinforcing bars of hard steel set in transverse rings are spiral wound with wire and set around the core before concrete is poured. Among uses are substation structures, transformer poles, feeder lines.—Elec World, Mr 13, 106

Place Footings in Snow—Sinking 4,350 cast-in-place concrete piles and footings for Boston's new air terminal was not hampered by deep snows. Three steam piledrivers drove 80 piles per shift through frozen ground. Piledrivers were followed closely by transit-mix trucks filling pile shells and footing forms with heated concrete.—Cons Meth, Mr, 86

Radiant Heating Plus—Where plants need a great many air changes per hour, radiant heating by pipes in the floor may not carry the load in severe weather. At the new Deer Park experimental laboratory of Shell Chemical Corp., 60 air changes per hr. (about 60,000 cfm.) were needed. This required preheating the incoming air in a plenum chamber outside the building.—Chem Eng, Mr, 126



STEEL GRATING EXPANSION JOINTS—In its 4,00-ft. oil landing wharf, Standard Oil of California uses these steel grating expansion joints at 600-ft. intervals. Placed before the asphaltic roadway surface, the joints provide for a 3-in. wide expansion.—Eng News-Rec, Mr 4, 70

Continuous Macaroni Process

Automatic mixers and presses are now replacing the batch process and yielding greater volume of macaroni products to satisfy the demand

CONTINUOUS MACARONI presses are now satisfying the demand for 1-billion lb. per year. The batch process is giving way to continuous operation because of better consistency and quality of product, and greater output per man.

Continuous presses have several features in common. First is an automatic measuring device that feeds the required amount of farinaceous material (semoline, farina or durum flour) into the mixing unit in the press. Next, a water-measuring device controls the flow of water to assure a dough of required consistency.

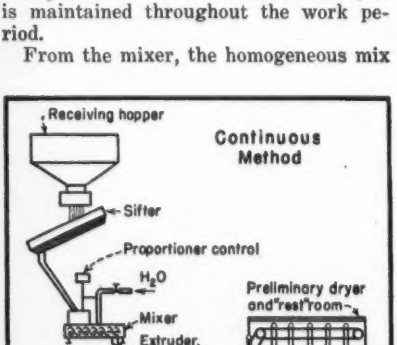
An ammeter indicates consistency by showing the electric energy required for mixing. Once the ingredient flow into the rust-proof steel mixer is established, it is maintained throughout the work period.

From the mixer, the homogeneous mix passes into the press where a steel worm kneads the dough and exerts a direct pressure to extrude it through the die. In another press the dough is a crumbly mixture before it passes through a series of rollers that work it into a thin sheet. As the sheet accumulates in a small chamber, it is forced through the die.

Extruded macaroni is then placed in strands—cut to proper length—on drying sticks by an automatic spreader, eliminating all manual handling of the dough. Strands of macaroni are conveyed on their drying sticks through a continuous preliminary dryer. Short goods after drying are conveyed to bins leading to scales and automatically weighed into cartons. Long goods are cut by machine and weighed into cartons by operators.

Enrichment in the continuous process is done by precision mechanical feeders, such as those employed in flour milling. Stainless-steel feed rolls deliver a ribbon of powdered enrichment premix across a feed apron to the head end of the mixer or into the main flow of the farinaceous ingredients.

Press capacity is about 1,000 lb. of macaroni per hr. One man can operate three to five presses. All processing takes place in completely closed machine units, thus safeguarding the cleanliness of product and protecting the worker from any possible injury.—Food Ind, Mr, 74



MACARONI INGREDIENTS are automatically fed into a continuous press where they are mixed, kneaded, extruded, and then carried through a dryer

SALT BATH REMOVES SCALE

Hot-rolled clad plate and sheet is descaled by Lukens Steel Co. in a molten sodium hydroxide and sodium hydride salt bath, instead of by the usual acid pickling process. Advantages include metal saving, processing-time reduction, more uniform descaling, and no pitting or embrittlement.—Elec World, F 28, 94

TOMORROW'S TEXTILES

Vegetable protein fibers will go into textiles. Industrial production of peanut, soybean and corn protein fibers may come this year. Solvent extraction will boost production of oils and protein meals. Cottonseed and flaxseed proteins are slated for a big role in textiles.

Protein fiber research is progressing. Tensile strengths of regenerated fibers improve. Hardening and stretching agents have been announced. Fibers are modified chemically. They are combined with natural or other synthetic fibers. Protein suspensions are extruded onto surface of cotton or other fibers.

One company, Virginia-Carolina Chemical Corp., will market a protein staple fiber, Vicara, in varying deniers and staple lengths.

Washing methods change too. Polyphosphates may soon replace soap entirely in woolen mills. They slash soap needs by 75%, improve detergency, and are effective in rinse waters in removing insoluble soaps and pectinates.—Chem Eng, Mr, 78

PLANE AT PORT 5 MIN.

Time-on to time-off the ground at Southwest Airway's Monterey, Calif., airport has been cut to 5 min. through efficient planning. And all of the ground work is handled by one man. Mail and passengers are checked in, then information is transmitted to pilots of the incoming plane. Before plane lands, outgoing baggage is on the ramp. Incoming passengers and baggage are unloaded and outgoing baggage is stowed in 1½ min. Attendant then mans the fire cart before engines are started.—Air Trans, F, 24

NEW LENGTH STANDARD

A new standard of length exists in the wavelength of green radiation of mercury 198, an isotope transmuted from gold by neutron bombardment. In precision, reproducibility and convenience, the new standard is superior to both the standard meter and the red line of cadmium. Preliminary measurements have shown an accuracy of one part in a hundred million of relative values, and one part in a billion theoretically is possible.—Prod Eng, F, 155

MOTOR AVOIDS WOUND ARMATURE— Developed by Westinghouse Electric Corp., single-phase, capacity-start induction motor has starting-torque characteristics so improved that it can compete with repulsion-start, induction-run motor. It has no wound armature, brushes, or short-circuiting devices. Heat treatment of rotors burns off punching burrs that provide short-circuit path for eddy currents.—Am Mach, F 26, 154

MESH-SHIELDED ROOMS

Two shielded rooms at Bendix Radio Div. television-receiver development laboratory are screened with ½-in. mesh, galvanized steel-wire hardware cloth on both outer and inner screens. Relatively open-mesh allows excellent interior illumination from fluorescent lights suspended over the enclosure and eliminates any radio interference from them. Open mesh also allows free circulation of air. —Electronics, Mr, 86

	CARS		TRUCKS		BUSES	
	1948	1940	1948	1940	1948	1940
Africa ..	507,181	543,740	202,164	140,099	7,783	5,750
America . (Less U. S.)	2,113,247	1,785,842	900,429	498,077	55,698	27,488
Asia ...	218,610	427,083	145,748	234,337	39,519	32,218
Europe ..	4,928,159	6,704,286	4,538,294	2,511,122	148,640	150,885
Oceania .	840,008	887,409	473,022	312,799	1,517	#
U. S.....	30,650,265	25,804,340	6,593,408	4,320,829	116,739	55,055
Total..	39,257,470	36,152,700	12,853,065	8,017,263	396,896	271,396
Total.. (Less U. S.)	8,607,205	10,348,360	6,259,657	3,696,434	253,157	216,341

Included as trucks.

WORLD AUTO OPERATION — Table, based on "American Automobile's" annual survey, shows an increase in automobiles in operation around the world over last prewar year. Figures are for units in operation Jan. 1 of year indicated.—Am Auto, Mr, 33

ALL-WEATHER ROLL-ONS GIVE HAPPY LANDINGS

Smoother plane landings can be obtained with "roll-on" landings than with the more frequently used stall type or 3-point manner. Surveys show that 20% of current landing are smooth, but with the new roll-on landings this may be raised to 80% in tricycle-landing-gear craft.

As the plane approaches the landing-field boundary, power is reduced to free-wheeling (zero thrust) condition of propellers. Planes with large propellers and engines benefit especially from this. When plane is about 5 ft. from the ground, it is flared gradually until a slow rate of descent is maintained—plane should not be leveled off. Soon wheels will roll on the runway in a smooth landing.

On tail-wheel planes, elevator control should be moved forward as soon as wheels touch, but need not be done in tricycle planes. Then throttle is closed. Wing flaps should be retracted to put additional weight on wheels to give maximum braking.—Air Trans, Mr, 34

DESIGN DEPARTMENTS GROW

American textile manufacturers are installing design departments to function between selling and manufacturing division and to take the experimental load off production machinery. Dan River Mills, Inc., is a good example. Equipped with the latest machinery, the department carries on development without bothering production departments.

Experiments in manipulation of fibers are conducted continually on cotton, wool, azlons, ramie, flax, Vinyon, nylon, and viscose and acetate rayons. New synthetics are tried as soon as sufficient yarn is on hand.—Textile World, Mr, 133

BONUS PLAN THAT WORKS

United Specialty Co. cuts the foreman in on bonuses given to employees in his section for work-simplification suggestions accepted. As a result of the plan, foremen now give workers helpful hints on development of their ideas. Worker is given a bonus of 25% of the estimated first year saving; the foreman is given 10% of the employee's bonus by the company.

Plan has resulted in added production, lowered production costs, and better relations between employees and foremen. —Factory, Mr, 84

THROUGH EGG PROCESSING

Washing, pasteurizing, and if desired, pulping of eggs are possible on a continuous machine developed by Vinall Egg Co., Adelaide, South Africa. Eggs are carried on rubber rollers through a hot-water trough, are brushed, sprayed, dried, and then oiled or automatically transferred to a pulping unit. Machine pulping gives 3% more pulp than hand methods.—Food Ind, Mr, 71

GAS TURBINE TOPS 1,000 HOURS ON TEST

Experimental 2,000-hp. land gas turbine, announced over a year ago by Westinghouse Electric Corp., has proved out on test runs totalling over 1,000 hr. Operation under all types of loading and up to design temperature of 1350° F. has caused no objectionable distortion and no serious creepage.

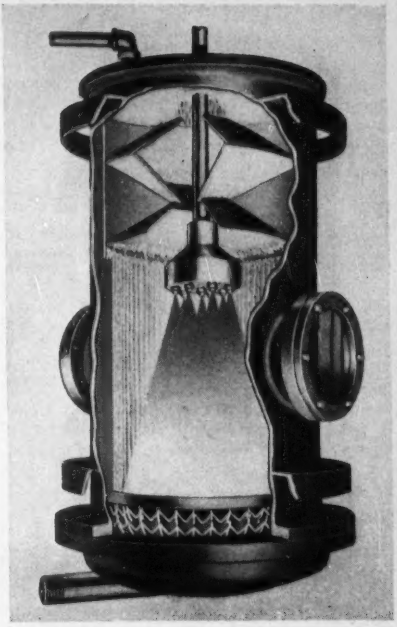
Over-all fuel rate at full load of 0.78 lb. per bhp.-hr. corresponds to a thermal efficiency of 16.7%, based on fuel heating value of 19,500 Btu. per lb. Maximum output developed was 2,220 hp. when operating with 48° F. inlet air to compressor. Adiabatic compression efficiency varied from 80-86% over the entire speed and load range. Turbine efficiency varied from 84-86% over the operating range.

Operating experience is encouraging. The turbine is easy to start and control, runs smoothly, and is not excessively noisy. No distress has appeared in any heated parts. Tests show clearly that a simple open-cycle gas-turbine power plant having a fuel rate of 0.6 lb. per bhp.-hr. can be built.—Power, Mr, 80

AID SEAMLESS KNITTING

A new stop motion and an oiling attachment have improved quality of 400-needle, 15-denier seamless hose at North Carolina State Vocational Textile School. Stop motion consists of an electric circuit kept open by normal yarn tension. It closes when yarn tension becomes tight or when yarn breaks. The circuit remains open, however, if the machine is stopped for maintenance. Needle breakage is lower, poor quality hose almost eliminated.

The oiling device lubricates and cleans needles and sinkers. The 15-denier yarns are more easily knit when passed through lubricating chamber placed above needles. There is less accumulation of size on latch needles after immersion than previously.—Textile World, Mr, 139



PROCESSES JUICES, OILS—Many applications in food factories are seen for the Hydro-Volifier developed by Buckeye Laboratories. These include cleaning and dehydrating vegetable oils continuously and deoiling, deaerating and concentrating citrus juices at 100 or 500 gph. Heart of the unit is a series of atomizing nozzles in a vacuum chamber (above). Water and volatiles are removed from the atomized fluid by suction. Oil being processed first is passed through a prefilter to remove dirt particles. Then a high-pressure pump forces it through the atomizing nozzles.—Food Ind, F, 96

NITROGEN-FREE HELIUM

Nitrogen-free helium for welding has been announced by the U. S. Bureau of Mines. Helium 99.8% pure is being produced commercially. It is passed through activated charcoal at −300° F. At this temperature nitrogen is absorbed.—Business Wk, Mr 13, 25

RADIOACTIVE TRACERS IN FLOTATION RESEARCH

Questions of flotation fundamentals may be answered by radioactive tracer research being conducted by Massachusetts Institute of Technology and Armour & Co. Researchers hope to find out where, and in what quantity, certain radioactive reagents come to rest in flotation pulps.

Carbon 14 is being used as the tracer because carbon can be built into many flotation reagents, it is easy to get, it remains radioactive for long periods, and its radiation is measurable but does not endanger personnel.

Reagent is weighed, placed on filter, and is inserted into combustion tube. Fluid covers sample, heating driving carbon as CO_2 into vacuum line to thermos-covered liquid oxygen trap behind burner. Fractional distillation moves CO_2 to monometric system. Liquid oxygen brings CO_2 over into Geiger tube, already holding 1-3 cm. of CO_2.

The Geiger tube, carrying radioactive CO_2, is placed on rack and connected to high voltage and to scaler that measures sample's activity by counting discharges. An automatic scaler tells quantity of carbon 14 in original sample.

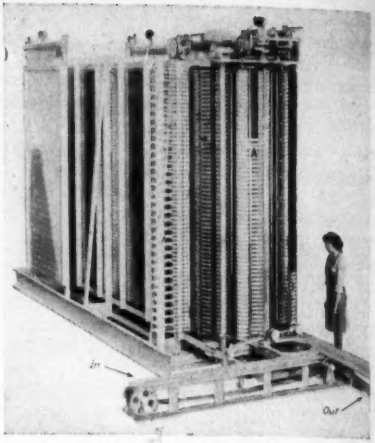
Tests hope to measure mineral surfaces more accurately, check on stability of collector coatings on mineral surfaces, measure concentration of other ions, and study collector ions with regard to their preferential attachment to mineral surfaces.—Eng & Min J, Mr, 53

LARGE BALANCED PACKAGES FOR WOOL CARPET PLANT

New spinning procedures for spinning wool carpet yarns are being employed in the new James Lees & Sons Co. plant. Unusually long feed boxes are used, the boxes being adjacent to openings in the wall separating the opening room from the blending room. Both breakers and finisher cards are clothed with metallic clothing, and attached to the first card is a Peralta device for removing burrs and vegetable matter. To produce more even yarn, breast is attached to finisher card instead of the breaker card.

Sixteen oz. packages are produced on frames having 7½-in. pitch and 5½-in. ring. Spinning packages go directly to pitch twisters without rewinding. Spinners and twisters are balanced so two spinning packages form a twister package without knots—one twister package making one winder package.

Room was manned by inexperienced hands, yet cost per lb. has been low from the beginning and costs are dropping as experience is gained by the hands. Straight-line flow from cards to winders is employed.—Textile World, F, 133



FREEZER NEEDS NO TRAYS—New automatic, continuous food freezer, operating from −25 to −50° F., assembles packages from the "in" conveyor on a pair of inwardly rotating screws A which feed them onto refrigerated shelves. After sliding through the series of shelves, frozen packages are ejected onto a screw B and lowered to the discharge conveyor. High heat transfer rates, possible with sliding contact between packages and shelves, mean quick freezing. Developed by Food Machinery Corp., the machine handles 1½-2 tons per hr. of food in domestic-size cartons.—Food Ind, Mr, 72

Revolution in Printing

Chicago strike of newspaper compositors has forced publishers to look for new composition methods. Industry is 5-10 yr. ahead researchwise

GRAPHIC ARTS have been pushed ahead 5-10 yr. in a matter of months researchwise because of the extended compositors' strike in Chicago. Using justifying typewriters and photoengraving processes, none of the five daily papers have missed publication deadlines.

After copy is typed on the justifying typewriters (copy aligned both right and left margin) to column width, the columns of copy are pasted onto page-sized cardboard sheets for photoengraving. After engraving, papers are printed in normal method.

These new printing methods are markedly reducing printing costs. A girl using the justifying typewriter can "set" an equal amount of copy in a day as a highly skilled linotype or Intertype operator. Typewriters cost about $700 while automatic type-composing machines cost up to $10,000 each. Makeup costs are similarly lower.

Two justifying typewriters now are on the market. Ralph Coxhead Corp.'s Vari-Typer has over 600 interchangeable type faces and sizes. Now under development by Coxhead is a machine that not only justifies on the right-hand margin but provides proportional spacing between letters for greater legibility. International Business Machines Corp. also makes an electric justifying machine.

Commercial Controls Corp. has a machine, still in development stage, that punches tape when keyboard is used, the type being run through a recording machine to produce justified copy. Fairchild Camera & Instrument Corp.'s Lithotype produces a type which looks just like the printed copy.

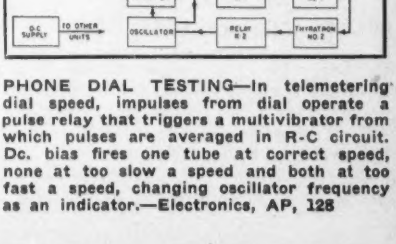
As the typing method of composition takes more time than standard methods, Chicago publishers are typing late news stories on metal addressing-machine plates, the plates being put into forms as substitute for time-consuming photoengraving.

Standard zinc engravings may soon be replaced by a new, light-weight magnesium alloy metal developed by Dow Chemical Co., the metal weighing but 1 lb. per page-sized sheet. New plates can be bent directly around rotary press cylinders eliminating stereoplating.

William J. Higgins Corp. has recently announced a machine combining a justifying typewriter, photoengraving, and magnesium press plates into one package. Typesetting and stereoplating are thus bypassed. A new method of engraving, developed by Fairchild Camera & Instrument Corp., engraves a plastic plate. A one-column newspaper engraving can be produced in less than 4 min.

The teletypesetter, now used by *Time* magazine, operates typesetting machines by remote control.

New in printing presses is Heubner Laboratories Inc.'s electro monographic press in which ink jumps gap between type and paper by electronic impulses.—Business Wk, Mr 13, 22



PHONE DIAL TESTING—In telemetering dial speed, impulses from dial operate a pulse relay that triggers a multivibrator from which pulses are averaged in R-C circuit. Dc. bias fires one tube at correct speed, none at too slow a speed and both at too fast a speed, changing oscillator frequency as an indicator.—Electronics, AP, 128

NEW AMPHIBIAN—Built by Aquaflight Inc., this 6-place amphibian has a metal fuselage and wooden hull. Tricycle landing gear retracts completely for water landing. Two 125-hp. engines develop a 125-mph. cruising speed.—Aviation Wk, Mr 8, 35

STEAM-HEATED AGGREGATE FOR — 20° DAM POURING

Pouring of a 60,000 cu. yd. concrete gravity dam in sub-zero weather at Portland, Maine, called for stock-piling of aggregate during warm weather. Steam heat from two boilers kept aggregate loose and kept top-quality, air-entrained concrete flowing to dam site in —20° F. weather. Boilers were 125- and 107-hp. type, first burning wood and then soft coal.

Timber, cut on the site, furnished 1,500,000 bd. ft. for cofferdam sheeting, bins, forms, and shop buildings; sawdust was used to plug cofferdam leaks and insulate steam pipes. Aggregate piles, containing 70,000 cu. yd. of processed sand and gravel, was in one 300x250x40 ft. pile in open end bins. Steam coils were placed under and on top of the aggregate piles.

Before pouring, Pumpcrete chutes were thawed with live steam for 5 min. per 100 ft. of chute. Concrete was poured in 5-ft. lifts in easily erected and stripped forms. Concrete was protected for three days by perforated steam lines under tarpaulins or by fan-type steam units.—Cons Meth, Mr, 80

BETTER FINISH, LESS COST

Tolerances to a few ten-thousandths inch and low microinch finishes, seldom associated with drilling, are now possible with carbide-tipped gun drills in boring machines and turret lathes.

On production work, aluminum alloys can be held to an average of 5 microinches, cast iron to 7-7½. Third benefit is a savings in time and money, by reducing machining time and the need for skill and experience in the operator.

Gun drills are made single- or multiple-stepped, with solid bodies, or with carbide wear strips set in the body. Chromium plating lessens wear and obviates galling and sizing.

Secret is that cutting action of the carbide tip is followed by a burnishing action by the drill body or wear strips. Essential is good lubrication provided by an oil hole lengthwise through the drill, so oil can flush out all chips and also get into the burnishing area.—Am Mach, Mr 11, 136

DRILLS HOLES FASTER

Faster drilling, controlled power feed, automatic bit rotation, and continuous hole cleaning are claimed for the new Ingersoll-Rand Co. blast hole drilling machine (see McG-H Digest, April, p. 47). In hard blue limestone, 47 ft. of 6-in. hole was drilled in 3¼ hr. In soft shale 40 ft. per hr. is possible.

Better fragmentation with a saving in secondary drilling and blasting can be obtained because of the ability of the machine to put down more 6-in. holes at closer spacing. Air drill is of piston type, the rod and bit reciprocating with piston; 200 blows are struck per min. Drill is carried on face of a welded steel tower and is fed by a 2½-in. single roller chain attached to drill cylinder. The air-operated feed motor can lift 16 tons.—Eng & Min J, Mr, 64

MULTI-PRODUCTION LINE

Three widely different toys are produced on a single straight-line manufacturing line at Charles W. Doepke Co. Present market for toys does not warrant separate lines for each toy. Manufacturing is on a monthly schedule. Press department changes over 2 wks. ahead of other departments to produce a backlog for the welding department. Other departments change over simultaneously.

After the 70 parts (average per toy) are welded together they are given a first inspection. Toys are then hung on an overhead conveyor, which carries them through dipping and spray-painting departments. They are baked at 350° F. for 6 min. Belt conveyor takes them to final fitting section where chains, tires, decals, etc. are affixed by hand. Then comes final inspection.—Factory, Mr, 74

SMALLER TRANSFORMERS

High-voltage power transformers are no longer made the structural giants they were. At comparable kva. and voltage ratings, they have become smaller because of three major developments. First stemmed from the discovery that lightning voltages could be shunted harmlessly to ground, resulting in greatly reduced insulation structure.

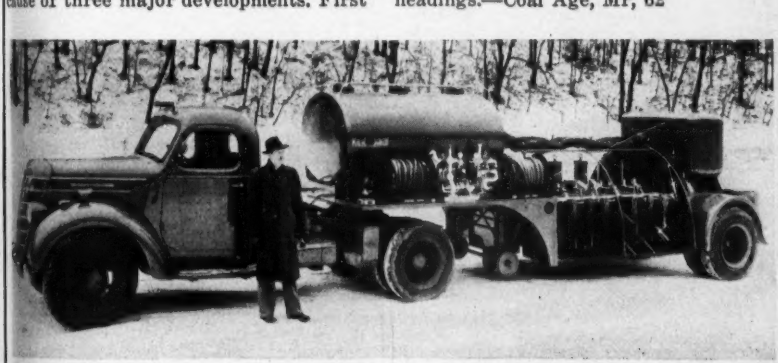
The second development leading to reduction in size was use of grain-oriented, high-permeability steel for cores. The third grew from tank designs that conform to the shape of modern shell-form cores.—Elec World, F 28, 74

LOADERS WORK 38-IN. SEAMS

Coal seams averaging 38 in. and dropping to 36 in. are being worked by low-type loading machines, prefabricated track, and large mine cars at many Pennsylvania mines. Production is averaging 18 tons per man-shift.

Trackage is 56½-in. gage; cars are 4-ton, drop-bottom type. Height is 25 in. over-all width 7-2/3 ft., length 19¼ in. Coal is deposited in cars in two longitudinal rows. Most entries consist of six headings each.

Recent tests with as few as three working places showed an increase tonnage per unit, per man-shift. Future workings will be limited to four or five headings.—Coal Age, Mr, 62



TESTS FILLING-STATION SITES—Designed to pretest filling-station sites, service heavy construction machinery, and ground-service large airplanes, this new machine was developed by John H. Adler, Pittsburgh, and is built by Jax, Inc. It has a 700-gal. gasoline and diesel fuel oil system, two batteries of nine hose reels each, and capacity for water, anti-freeze, kerosene, and diesel lubricating, hoist and jackhammer oil. All of the various operations are air controlled.—Am Mach, F 26, 123

NEW PRODUCTS

Amplidyne Control Packaged—General Electric Co. unit brings together all adjusting rheostats, capacitors, rectifiers, and instruments for the amplidyne-regulating circuit. Designed for steel-mill and processing line control applications, it also provides motor speed-limit control, field forcing during acceleration and deceleration, and stabilizing functions.—Power, Mr, 155

Small, High-powered Tractor—A rubber tired, 7½-hp. bulldozer operates all day on 2 gal. of gas. It weighs 885 lb. and has a 40-in. wheelbase. It has automobile-like steering gear and gear shift lever. Friction clutch disengages automatically when engine speed drops below a certain rpm. The National Iron Works bulldozer has a power take-off.—Eng News-Rec, Mr 4, 106

Palm-size Valve—Quick closing valve, developed by Paul Valve Corp., operates with only two moving parts—plunger and controlling ball. Pushing the button causes the plunger to roll the ball off its seat, giving instant full flow of 13 gpm. Available in standard hose sizes from ¼ to 1 in., the valve is made of Monel and is rubber-coated to prevent scratching interior tank surfaces.—Food Ind, Mr, 167

Electric Psychrometer—Announced by Minneapolis-Honeywell Regulator Co., an aspirating psychrometer indicates temperature deviation to within 1/5°. Motor-driven instrument has wet- and dry-bulb thermometers reading from 40 to 120° F.—Elec World, F 28, 102

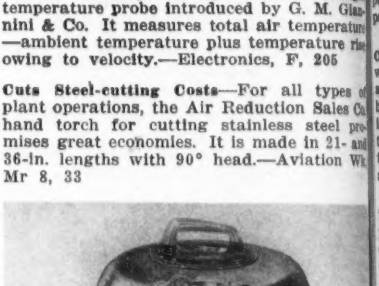
Portable Aluminum Sawmill—Using 17S-T aluminum alloy, the Augusta Iron Works designed a portable sawmill entirely of aluminum. Carriage, capable of handling 16-ft. logs, is of 5-in. extruded I-beams; 34-in. extruded I-beams were used for the 45-ft. long runway and the 10-in. husk frame housing machinery. Frame members are bolted together.—Eng & Min J, Mr, 92

Cuts Fuel Oil Consumption—Oil in burner flows into a firing head where it is mixed with air, then heated by baffle at 1000-1600°F. in the new Consolidated Industries, Inc., oil burner. Finally converted to a gas, the oil is forced through jets into combustion chamber. Running at 90% efficiency, burner works on hot-air furnaces and steam and water boilers. Fuel consumption reportedly is cut 50%.—Business Wk, F 21, 62

Grinds from Solid—Automatic universal flu grinder, manufactured by the Wardwell Mfg Co., grinds flutes from solids in drills as small as 1/16 in. dia., spiral- or straight-taper reamers, and spiral or straight millin cutters.—Am Mach, Mr 11, 218

Takes Test-flight Temperatures—Reduction of data on test flights of aircraft or guided missiles is simplified by a new Autoflight temperature probe introduced by G. M. Giannini & Co. It measures total air temperature —ambient temperature plus temperature rise owing to velocity.—Electronics, F, 205

Cuts Steel-cutting Costs—For all types of plant operations, the Air Reduction Sales Co. hand torch for cutting stainless steel promises great economies. It is made in 21- and 36-in. lengths with 90° head.—Aviation Wk Mr 8, 33



TRIPLE-FILTER VACUUM CLEANER—Canister-type cleaner unit has three filters to remove dirt particles from the air. As the air enters, it is deflected by a baffle plate and given a centrifugal whirl. It then passes up through a rayon-hemp fiber filter, a treated cloth filter, past the motor to cool it, through a cellulose-fiber filter and out the finned diffuser. The third filter acts as a silencer and removes carbon particles coming from the motor. Developed by Lewyt Corp., the cleaner has a 2-stage centrifugal fan driven by a ¾-hp., 16,000-rpm. motor. With a closed orifice, water lift is 61 in.—Prod Eng, Mr, 92

Phase-Rotation Indicator—Selco, developed by H. Sell Electric Co., is a self-contained instrument to phase power outlet in factories where welders are used, to reestablish disrupted service with power of proper phase sequency, and to phase out new equipment such as transformer banks. It indicates phase sequence by numerical, alphabetical, color coding, and CW-CCW methods.—Weld Eng, Mr, 74

Dumbbell-shaped Reinforcing—Shaped like a dumbbell, Webrib Steel Corp.'s new concrete reinforcement bar is cold spiral bent and stretched to increase yield point by 50%. Minimum yield point is not less than 60,000 psi., permitting design at a stress of 30,000 psi.—Eng News-Rec, F 19, 170

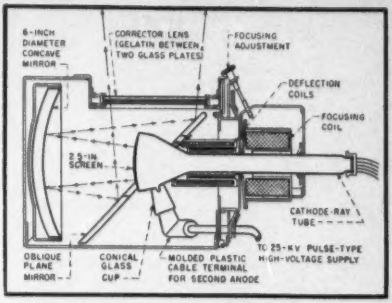
Controls Colored Lights—Colored lights in window displays can be controlled as to color and intensity by a new controller developed by Color Lighting Corp. Changing of filters is not necessary. Unit resembles a radio with two dials—one knob controlling color selection, the other light intensity. Over 500 hues are possible.—Business Wk, Mr 6, 64

Two Parts Move in Comb Box—Only two parts move and no oil is used in a new comb box. Both ends of combs are mounted on sealed ball bearings, reversible adapter plate being fastened to box by four screws, permitting conversion to right- or left-hand box. It is a development of Odom Machine Mfg. Co.—Textile World Mr, 145

Tiny Turbine—Weighing less than 5 lb., turbine refrigeration unit has been produced by AiResearch Mfg. Co. for cooling interiors of jet-propelled planes. It can drop air temperature 135° F. at 7-lb. per min. air flow. Rotor revolves at speeds over 100,000 rpm.—Prod Eng, Mr, 176

Sprayed Building Material—Pyroc, a building material applied by spray gun, can be built up to a thickness of 8 in. and it sets in 50 min. Made of lime, cement, and Vermiculite, it is non-cracking, will adhere to metal or wood, takes nails or screws, and can be sawed. It is a development of C & T Painters, Ltd., London.—Eng News-Rec, F 26, 5

Develops Crash Guide Light—To guide searchers to crashed planes, R. A. Shellabarger has developed a 4-lb., 4-in. dia. light to be fastened to plane wings. When plane crashes, lights are thrown free of wreckage. Two 6-volt batteries power four bulbs in unit; lights will burn for 100 hr. CAA tests show light to be visible at 10,000-ft. altitude.—Aviation Wk, Mr 15, 22



PROJECTED TELEVISION—**Large clear television picture, 12x16 in., is obtained from North American Philips Co. Protelgram. Unit consists of 2.5-in. dia. cathode-ray tube, optical projection unit including focusing and deflection coils, and 25-kv. high-voltage supply. The small tube face permits use of relatively small components, the concave mirror being only 6 in. dia. Over-all optical efficiency is 15% after allowing for masking, reflection, and transmission losses. Masking is reduced to minimum by protruding only the tube face through the plane mirror.—Electronics, Ap, 72**

Cam-Duplicating Lathe—Hydraulic lathe, developed by The American Tool Works for reproducing work from a revolving templet, turns cams from a disk in one cut. The revolving templet, supported at the rear of the machine, can be a finished camshaft or a shaft with a series of loose cams.—Am Mach, F 26, 140

Rubber Belt Has Teeth—Working on special grooved pulleys, a steel-reinforced rubber belt produced by L. H. Gilmer Div. of U. S. Rubber Co. makes positive engagement at any speed up to 10,000 fpm. Use is indicated where extreme accuracy of relation between driving and driven pulleys is necessary.—Chem Eng, Mr, 146

Fare Box Makes Change—Time for loading a bus can be cut by a new fare box that receives fare, records it, and makes change. Any coin can be taken by the machine at 100 fares per min. Developed by Advance Products Co.—Bus Trans, Mr, 193

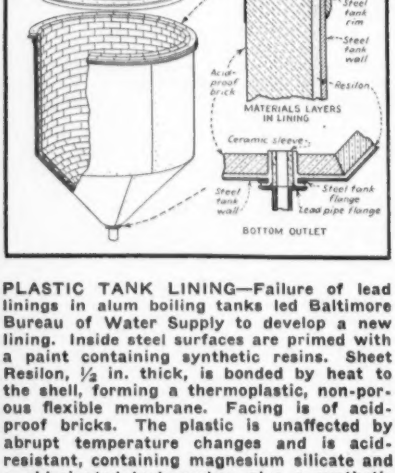
Seals Floors—Penetrating deeply into wood, a new floor sealer leaves no surface film, seals all pores, and produces a smooth but not slippery finish. The Vita-Var Corp. development can be applied to any type wood floor.—Cons Meth, Mr, 130

NEW PRODUCTS

Packaged Power—A packaged turbine hydro-electric plant requires 20-150 ft. differential between water level supply and turbine to deliver 5-67 hp. Ac. is produced in standard voltage. With no packing glands to be affected by abrasives in water, turbine is direct-connected to generator. It was engineered by Northwest Machine Works.—Business Wk, Mr 20, 72

Glues Edge-bonded Blanks—High-frequency glueing machine, Raybond, has capacity of 1,200 sq. ft. of edge-bonded blanks per hr. Developed by Electronic Heating Associates, it requires one operator and takes wood from ⅝-2 in. thick.—Electronics, Mr, 218

Fluorescent Automatic Switch—Automatic transfer switches for fluorescent lighting circuits are designed to drop out 75-93% of voltage with pickup at 95%. Voltage ratings are 110-550 at 60 cycles. Developed by Automatic Switch Co.—Elec C & M, Mr, 99



PLASTIC TANK LINING—Failure of lead linings in alum boiling tanks led Baltimore Bureau of Water Supply to develop a new lining. Inside steel surfaces are primed with a paint containing synthetic resins. Sheet Resilon, ½ in. thick, is bonded by heat to the shell, forming a thermoplastic, non-porous flexible membrane. Facing is of acid-proof bricks. The plastic is unaffected by abrupt temperature changes and is acid-resistant, containing magnesium silicate and a chlorinated hydrocarbon plus a synthetic resin base. Service life is at least twice that of lead linings.—Chem Eng, Mr, 102

Diamonds Saw Contours—A diamond ba... sawing machine, developed by DoAll Co., ... hardened steel, tungsten carbide, stone, ... vitreous materials to layout lines with c... dimensional control and fine finish. Impr... nated teeth are cylindrical segments cons... ing of diamonds tightly bonded in a sinte... tungsten alloy matrix.—Am Mach, Mr 11, ...

Heats Cylindrical Surfaces—A Chrom... cast-in-aluminum tubular electric heater ... been developed by Edwin L. Wiegand Co. ... provide uniform heat to plastic extru... and injection molding machines. It is ... plied to cylinder as two halves clamped ... gether by bands.—Prod Eng, Mr, 171

Vulcanizes Electric Cable—On-the-job ... pairs of bad spots in cable jacket can ... made with a new cable vulcanizer, elimin... ing the scrapping of otherwise good cab... Two types are available. One applies therm... statically-controlled heat direct to mold... other heats mold by controlled steam pre... sure. It is a development of Mines Equip... ment Co.—Factory, Mr, 202

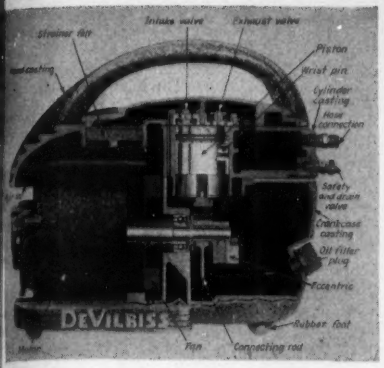
Resists Produced on Nylon—White or co... ored resists can be produced on nylon wi... Nyon Resist GDC. It is applicable to colore... or uncolored nylon yarn intended for decora... tion and to fabrics containing nylon an... wool where a 2-tone effect is desired. It wa... developed by General Dyestuff Corp.—Textile World, Mr, 154

Portable Cord Reel—Extension reel, desig... nated the Port-O-Reel by the manufacturer, ... Industrial Electrical Works, handles up t... 400 ft. of small diameter cord. Current i... transmitted through a contact collector ring ... —Elec World, Mr, 20, 29

No Fog on Glasses—Fogging of eyeglasses ... and car windows is prevented by anti-fog... ging agent made by E. I. du Pont de Nemours ... & Co. Essential ingredient is Duponol ME ... Dry which causes condensing moisture to ... spread out a clear film.—Chem Eng, Mr, 16...

Faucet Mixes Water—A single handle in the ... new General Pacific Export Co. faucet con... trols both volume and temperature. Flow is ... controlled by downward pressure on the ... handle.—Business Wk, F 21, 62

High-speed-loom Picker—Longer life, better ... shock absorption, and life-long alignment ... are promised by Graton & Knight Co. high-... speed-loom picker. Nose is lined with layers ... of oak-tanned leather and raw hide cemented ... together. Drilled nose hole receives impact ... from shuttle spur and quickly dissipates ... heat.—Textile World, Mr, 145



PORTABLE AIR COMPRESSOR—DeVilbiss single-cylinder ¼-hp. compressor for paint spraying delivers 2.6 cfm. at 40 psi. pressure. Enclosed in three-piece cast-iron housing, the 15-in. long unit has the compressor direct driven from the motor. A motor end shield is cast in the crankcase and the motor flange mounted on a pilot on the end shield. Air filter, intake and exhaust valves, and handle are included in the cylinder-head casting. Pulsator chamber is in the cylinder casting.—Prod Eng, Mr, 99

Ultra-microtome—Designed to cut sections 0.000004 in. thick for electron microscope study, a new ultra-microtome has been developed by Custom Scientific Instruments. Razor-edged blade rotates at 60,000 rpm. at speeds up to 800 mph.—Textile World, Mr, 123

Prefabricated Plater — Electroplating units for laboratory and production purposes are made as easily assembled prefabricated parts by Unit Process Assemblies, Inc. The equipment includes plating and process tanks, rectifiers, and built-in gas, electrical, water, drain and exhaust lines.—Chem Eng, F, 166

Gives Pilot Approach Angle—Moveable angle-of-approach, to give incoming pilots continuous proper approach angle information, has been developed by Westinghouse Electric Corp. Lights flash at rate of 40 times per min. Yellow indicates too high an angle, red too low, green proper angle. Unit uses 105 watts at 115 volts.—Aviation Wk, F 9, 33

Kills Germs Fast — Westinghouse Electric Corp.'s new germ-killing ultraviolet lamp doubles ultraviolet output of previous lamps. The 25-watt, 36-in. long tube has a rated life of 6,000 hr.—Business Wk, Mr 6, 64

Electric Eraser—The new 12-oz. electrical eraser of Chicago Wheel & Mfg. Co. is balanced and shaped to fit hand. Protective sleeve covers all moving parts and quick-change chuck accepts any standard eraser. Foot speed control is optional.—Elec Merch, Mr 1, 162

Magnetic Road Sweeper—Consisting of six permanent Alnico magnets mounted along a 36-in. bar supported at the ends by rubber-tired wheels, a new sweeper removes loose nails from roads and loading yards as it is pushed over the surface. Cesco, Inc., developed the unit.—Cons Meth, F, 146

Truck Handles Rolls—Designed by Ironbound Box & Lumber Co. to handle heavy cylindrical objects, the manually operated truck has a non-slip arm that holds the object firmly on the truck platform. Capacities are 32- or 40-in. dia. and 800- or 1,500-lb.—Food Ind, Mr, 172

New Brake Lining—Known as PGT sets, new brake linings developed by Raybestos-Manhattan Inc., are factory matched from seven different friction materials to meet individual needs of various types of trucks.—Eng News-Rec, Mr 4, 103

Diesel Air Starter—Handling engines up to 600 cu. in. displacement, the starter consists of 7-hp. air motor with a Bendix starting drive. Offering reasonable initial cost, negligible upkeep, and reliability of air starting, it was developed by Chicago Pneumatic Tool Co.—Power, Mr, 156

Gages Go Light—The Nilco dial snap gage, developed by the Nilsson Gage Co., Inc., is machined from rolled magnesium with 45° angles to provide rigidity and minimize dimensional variations from temperature.—Am Mach, Mr 11, 212

Unloads Cartons—Glass bottles can be unloaded automatically from re-shippable cartons. Cartons are fed by gravity conveyor into the machine which opens lower outer flaps and removes bottles. It is a development of A-B-C Packaging Machine Co.—Business Wk, Mr 13, 64

FREE SERVICE TO READERS

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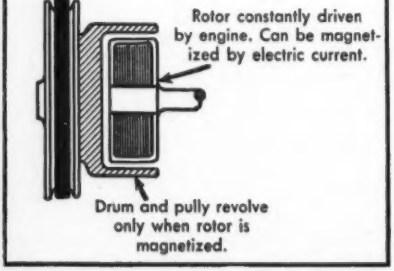
Drive Finds Many Applications

Developed to drive automobile accessories, Eaton Mfg. Co.'s dynamic drive is being applied to wire drawing and textiles, home appliances

DEVELOPED TO RUN automobile accessories, Eaton Mfg. Co.'s dynamic drive is finding application in fields of wire drawing, home appliances, and textiles. The device works on the basic principle of a simple electromagnet—when a conductor of electricity is moved through magnetic lines of force, electric currents are induced.

The drive consists of a soft-iron drum (conductor) with a rotor assembly fitted into it. The rotor is made of magnets and coil and is turned continuously by engine. With current applied to rotor, magnetic lines of force are created and drum revolves. The greater the load on the drum, the greater the force exerted by drive.

First applied to drive an automobile fan, the unit will drive the fan only when motor is hot, instead of all the time as in mechanical connection of fan to engine. In this application, the rotor is turned by the crankshaft, the flow of current being thermostically controlled.


Belt to fan, etc.
Rotor constantly driven by engine. Can be magnetized by electric current.
Drum and pully revolve only when rotor is magnetized.

There is no contact between soft-iron drum and rotor in Eaton's dynamic drive

Eaton hopes to use the device for other automobile accessories, including heater and ventilator, windshield wiper, water pump, and generator.

In the textile and steel industries, it can maintain even tension in winding, coiling, and spooling operations. A more uniform product will result. Should the machine break down, the preset tension cannot be exceeded.

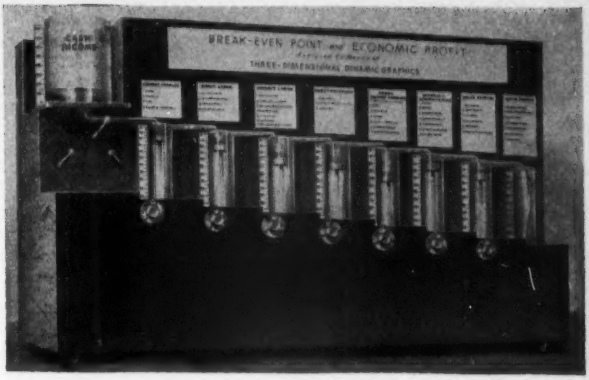
For home-heating, the unit can be placed between furnace blower and motor and controlled by a thermostat in furnace bonnet to give uniform instead of surging heat.

The drive can be regulated by single automatic controls, by hand rheostat, or by electronic controls. They can be made responsive to temperature, speed, pressure, time, or mechanical position.—Business Wk, F 28, 55

DIE LIFE IMPROVED

Raising power-press production by increasing die life means lower manufacturing costs. Improvement in die life is made possible by proper press reconditioning. The same die, which previously produced 45,000 punchings per grind, stepped up to 90,000 when run in a press rebuilt and strengthened to reduce deflection in the press frame and interference of die members.

Deflection can be controlled too by selection of the right size of press. In event of short die runs, a press two sizes larger may correct the conditions. One size larger may not be enough. A 35-ton press, for example, springs 0.006 in. under full load. A 56-ton press would spring about 0.0055 in. under the same load, whereas the next larger size, about 80 ton, would deflect only 0.003 in.—Am Mach, F 26, 79



THREE-DIMENSIONAL ECONOMICS—These tubes and tanks show employees of the Willys-Overland Motors what is left as profits (far right tube) after other costs are met. W-O uses these 3-dimensional graphs to supplement explanation of company economics. Liquid in tubes flows the same as cash income.—Business Wk, Mr 20, 99

JETS PROMINENT IN WORLD AIR POWER

United Kingdom—Limited resources are being put into projects which will not be completed for 7-10 yr. The British, so far as combat planes are concerned, are gambling on 5 yr. of peace, for today they haven't the manpower or resources to build a first-rate combat air arm. New postwar jets have been developed and flown but orders have not been placed by the services. No British plane will be built for which they can see no operational future.

Government expenditures for aircraft this year are less than half of those a year ago; appropriations will probably be smaller next year. One commercial feeder-line transport, engineered by Cunliffe-Owen, has been shelved.

Russia—Her aeronautical research program is probably 5 yr. ahead of schedule because of German equipment, physical plants, scientists, and knowhow. Russian production capacity at 40,000 planes a year in 1946 is probably 75-100,000 planes a year now. Civil airlines are readily convertible to military use.

During 1948 and 1949, Russians plan a 2-fold expansion in passenger traffic and 3-fold expansion in air freight. Air mileage by 1949 will be 108,200 miles.

France—Military air power is out of date today and the decline will continue. Personal flying is increasing in both number of pilots and fields, but planes are scarce. In commercial service, Air France remains a leader with an increasing number of planes and added business. Jets are not expected before 1950 or 1951. Production of planes in 1947 fell to 1,445,501 below the 1946 figure.

Sweden—The only Scandinavian country with its own aircraft industry, the country still is manufacturing planes of foreign design, but is also producing some of its own design. The J-21 jet fighter is one. Research and construction experiments are being undertaken. SAAB, Sweden's only plane manufacturer, will unveil soon a jet fighter prototype capable of over 650 mph.—Aviation Wk, F 23, 79, 80, 82, 87

STORE COAL UNDERGROUND

Several West Virginia coal mine operators are storing coal underground when mine cars are temporarily unavailable rather than shutting down temporarily. The cost of rehandling is less than laying off a section. Coal is dumped by shuttle cars close by shuttle-car elevator. It is rehandled when loading unit is up with regular production.—Coal Age Mr, 98

TAPS FLUTE-SHARPENED FOR CLOSE TOLERANCES

Faced with tapping of holes to Class 3 tolerances in the small-thread series, from size 0 to ¼ in., General Electric Co. was unable to attain required accuracy on a high production basis.

Investigation showed the trouble lay in the wide variation in hook angles of purchased precision taps and in uneven indexing of cutting edges around the tap body. Accurate hook grinds were found to improve tap performance greatly, and consistency in hook angles had a marked effect on size of tapped hole produced.

A difference in effective hook angle between various flutes and inaccuracy in indexing of cutting edges caused taps to cut oversize. But accurately ground hook angles and equalized spacing reduced the torque needed to drive the tap into the material, and the correct angle improved surface finish and increased tap life.

Solution to the problem was adoption of flute sharpening plus grinding of a second radius in the flute and spiral point of the tap. Hook angles were established for various materials, and grinder settings were determined to give the effective hook angles required. These varied from 5° for brass, bronze and cast iron to 8° for mild steel and plastics, 12° for stainless steel, Monel and magnesium alloys, and 18° for aluminum alloys.—Am Mach, Mr 11, 133

AUTOMATIC BOBBIN SUPPLY

Automatic replenishing of filling bobbins in loom batteries will soon be possible with a weave-room conveyor system designed by Draper Corp. On tests in a 12-loom cotton mill, the system is not working completely satisfactorily, but the manufacturer believes remaining bugs can be eliminated easily. Soon battery tender costs may be eliminated. System, at present, is restricted to mills that use one or only a few filling yarns.

Also running at test at Draper is a mock-up of a cross-laying machine to cross-lay unspun webs of several types to produce non-woven fabrics. Currently 20-in. wide material is being produced; design of a 40-in. wide machine is practically complete.—Textile World, Mr, 11

FLOATING PILEDRIVER SETS R.R. BRIDGE PILES

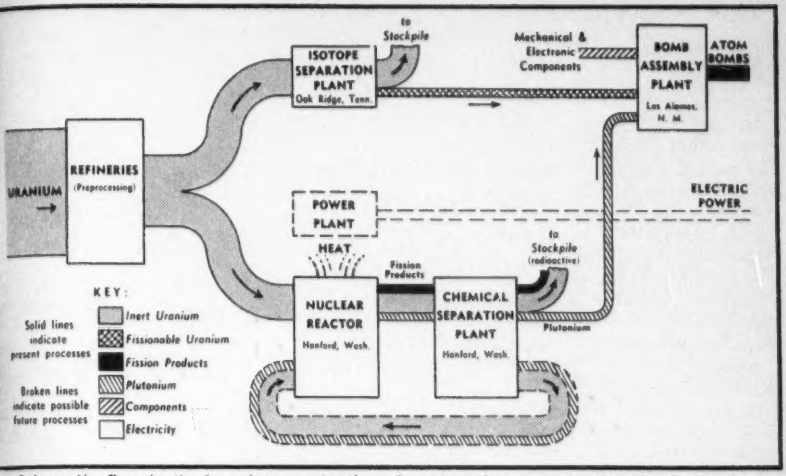
Deep water, long piles battered in several directions, and close working clearances problems were solved by a barge-mounted piledriver to replace 256 piles in a single-track, 15-span railroad girder bridge. Rig placed 95-ft. piles and drove them in any direction on the surface of any cone having a slope not greater than 3¾ in. per ft of height.

The original 16 wooden piers were replaced with piers of tubular steel piles capped with reinforced concrete beams. New piers were spotted at center of old girder spans and steel piles located outside girder lines to permit driving without interruption of train traffic. After completion of the piers, girders were shifted endwise one-half their length and seated on new piles.—Cons Meth, Mr, 10

TO EXPAND JET-PIERCING

Commercial use of jet-piercing (formerly called fusion-piercing, see McG-H Digest, Jan '47, p. 10) is expected by mid summer. Rig will have a minimum capacity of 100-150 ft. of hole per shift. Tests have been conducted with a smaller rig for producing holes at any angle from horizontal to vertical.

It consists of a blowpipe mounted on a standard wagon drill; power unit and auxiliaries are carried on a separate truck. Holes of 3½-in. dia. were produced by the 14-ft. blowpipe in high-grade quartzite, dolomite, low-grade iron ore and granite. At 30° angle to the horizontal, holes progressed at 35 ft. per hr. —Eng & Min J, Mr, 74



Schematic flowsheet of nuclear production—from uranium ores to the atomic bomb

ATOMIC PROGRESS —U. S. Development To Date

Report to Management

WHAT HAS HAPPENED to the United States' atomic energy program since the first bomb was constructed, then fired, at Alamagordo, New Mexico, on July 16, 1945? This, today, is the world's most pressing question.

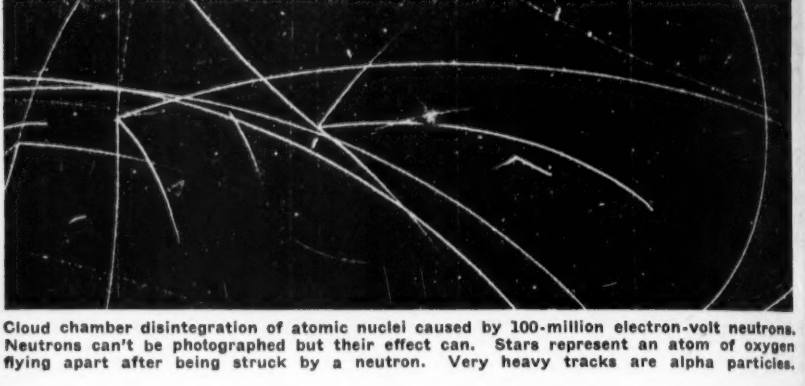
The *McGraw-Hill Digest*, through its Washington Bureau, has re-examined the entire atomic energy program, starting with beginning of the program, through Hiroshima, and up to the present. We did not ask for, and most certainly did not get, any secret or classified information.

We did get a clear picture of the program — as clear a picture as can be given an outsider— from talking to government leaders in the atomic field and to industrialists working with atomic energy. We also visited all the atom plants and laboratories in the country.

World interest centers on atomic bomb construction. With the troubled world situation today this interest is understandable. But application of the atom's power to non-destructive uses does compete for world interest. It competes in the United States for both materials and talent. But work in this field is slower than in the field of bomb development. This is a harsh and horrible fact.

The atomic age opened mid-1945. It is, in reality, a new age of man. People throughout the world watch the United States and other countries at work in atomic development. In the U. S., military applications of atomic energy are being continued, while non-destructive applications are being investigated.

In order to economize, the government has put much of the responsibility for research in non-destructive applications—mostly power applications — into the hands of academicians.



Cloud chamber disintegration of atomic nuclei caused by 100-million electron-volt neutrons. Neutrons can't be photographed but their effect can. Stars represent an atom of oxygen flying apart after being struck by a neutron. Very heavy tracks are alpha particles.

The power applications are being handled conservatively in a step-by-step way.

In the U. S., atomic development is government controlled by law—the country's first big government-controlled industry. Never before has so potentially important a technology been placed specifically under the government's control.

Production of fissionable material (see glossary, page 56) is by far the biggest part of the program. This, and the production of atomic weapons, has been, and will remain, a government monopoly.

Bomb Production

The first atomic bomb was constructed and fired early in mid-1945. It was a plutonium bomb. This test bomb was followed two weeks later by the uranium bomb dropped on Hiroshima.

Production of bombs has continued since that time. This stockpiling of bombs is expected to continue until late next year or early 1950 at an undisclosed rate. At that time new facilities at the Hanford plant will be added. So by 1951 or 1952 the production should be increased substantially.

At the end of the war, the U. S. had four major plants devoted to bomb development. Two were at Oak Ridge, Tennessee, for the separation of the natural explosive uranium 235. At Hanford, Washington, the synthetic explosive, plutonium, was produced. The Los Alamos, New Mexico, plant was devoted to assembly of bombs.

The first plant, Y-12, to deliver appreciable quantities of explosives was the electromagnetic plant at Oak Ridge—operated at that time by a subsidiary of Eastman Kodak Co. The plant contained a maze of machinery—among the machinery being calutrons which produce U235.

The calutron is a modified and enlarged mass spectograph. Uranium is broken down into electrically charged molecules (ionized) and the ions are shot at high speed past a tremendous magnet which deflects them to one side. The U235 ions are deflected more than the heavier and non-explosive U238. This difference in deflection permits the drawing off of the ions at different places.

No method has been developed to ionize uranium in quantity. Each machine has a low output, power consumption is high, and manhours needed to produce a pound of uranium are out of proportion to alternative methods of production. So early in 1947 large scale production was halted. Some calutrons are still

being operated, in effort to find a way around the natural low efficiency of the process. Others are being run to separate naturally occurring isotopes of elements other than uranium for scientific use as tracers.

After abandonment of Y-12, a new plant, K-25, and a new method for obtaining U235 were developed. The K-25 plant is believed to be the largest industrial operation ever to be carried out under one roof.

New Problems Faced

Difficult and unprecedented industrial problems were met—in pumping, in corrosion resistance, in welding techniques, in high vacuum, in leak detection, in instrumentation.

In K-25, uranium combined with fluorine to form a gas is forced through stage after stage of sieves, the lighter isotope U235 passing through the sieves and the heavier U238 remaining behind. The end result is enriched in U235. But the process is wasteful of nuclear fuel, extracting only about 0.7% from uranium. The other 99.3% is "waste."

K-25 will continue producing concentrated U235. It may be used as concentrated fuel for certain types of reactors. Operation of the plant since the war has developed many shortcuts and equipment changes.

At Hanford, the more plentiful type of uranium, U238, is utilized. It is transmuted into the element plutonium which is fissionable.

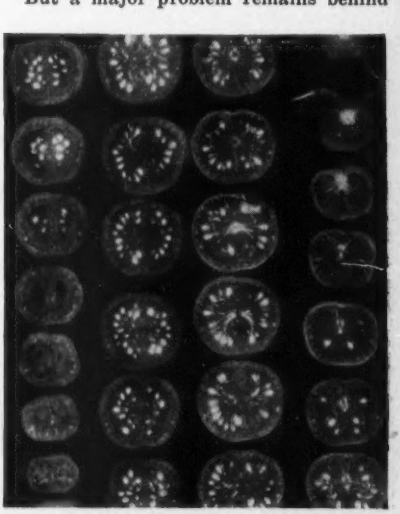
The operation at Hanford—transmuting U238 into plutonium—was a new experience to man before December 1942. The dream of ancient alchemists had become a reality.

Shortly after the chain reaction in the first pile was turned on, the reaction stopped. Pieces of the split uranium atoms were "poisoning" the pile. The trouble was diagnosed and corrected in a matter of hours. This pile was started in December 1942 to produce sufficient plutonium for one bomb. The scientists at that time had no idea the pile could be kept in operation until 1948.

No effort is made at Hanford to separate U235 from U238, identical isotopes differing only minutely in weight. Instead the U235 is "burned up" in the chain-reacting pile, the burning transmuting a little of the inert U238 into the element plutonium, an element never found free in nature. Then the plutonium can be separated by comparatively straightforward chemical methods.

Each pile is essentially a stories-high block of pure graphite encased in some feet of concrete shielding. Slugs of metallic uranium, sealed into aluminum cans, are inserted into the block. Because the pile is above the critical mass, and because the graphite acts as a moderator, a fissionable chain reaction takes place in the U235 content of the uranium. Later the uranium slugs are removed, dissolved in acid and put through a series of precipitations and resolutions to separate out the plutonium.

But a major problem remains behind



Radioautograph of radioactive phosphorous in tomatoes

the plutonium—tons and tons of a mixture of working chemicals, water, uranium, and fission products which are radioactive, taking years to die away. The disposal of these "waste" materials is a grave problem, one which may make permanently impossible the operation of any large number of high-powered chain reactions.

A new Hanford plant will use fairly conventional graphite-moderated piles with natural, rather than enriched, uranium. It will run cold, rather than hot, permitting utilization of its power output.

Non-Military Use

Military application of nuclear fission has been, and will for some time probably continue to be, the most talked-of feature of the science. But non-military applications of nuclear fission are becoming more and more apparent.

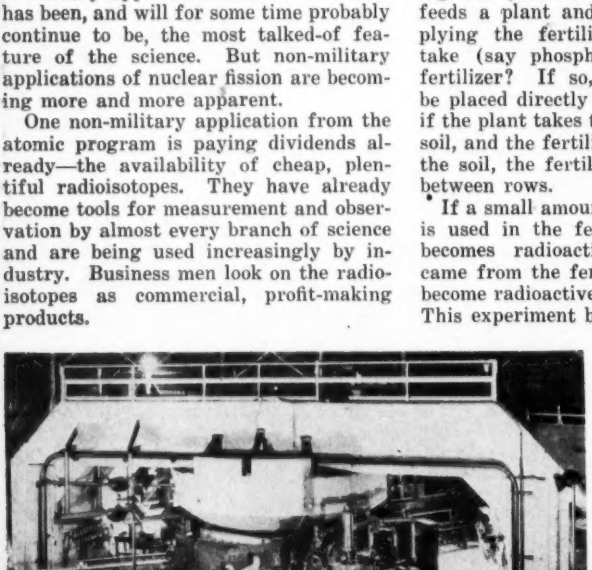
One non-military application from the atomic program is paying dividends already—the availability of cheap, plentiful radioisotopes. They have already become tools for measurement and observation by almost every branch of science and are being used increasingly by industry. Business men look on the radioisotopes as commercial, profit-making products.

Radioisotopes are fairly familiar. Cans of selected materials are inserted inside an atomic reactor and artificial elements are manufactured. These artificial elements have the same chemical properties as elements in their natural state; most other properties are the same except for one thing. The artificial elements give off continuously a detectable radiation over a certain period of time.

Thus extremely small quantities of radioactive elements can be detected and measured, and these elements can be distinguished from their non-radioactive, non-tagged brothers. This makes tracer technique possible.

For example, farmers have been arguing for years as to how fertilization feeds a plant and the best way of applying the fertilizer. Does the plant take (say phosphate) direct from the fertilizer? If so, the fertilizer should be placed directly into the furrow. But if the plant takes the phosphate from the soil, and the fertilizer merely replenishes the soil, the fertilizer should be applied between rows.

If a small amount of radiophosphorous is used in the fertilizer and the plant becomes radioactive, the radioactivity came from the fertilizer. If it does not become radioactive, it drew from the soil. This experiment began mid-1947.



Nuclear research is being carried out by this 184-inch cyclotron at Berkley, Calif.

Consider the catalytic process for synthesis of oil. If carbon monoxide and hydrogen are mixed, nothing happens. Add iron or cobalt, and the two gases combine to form a hydrocarbon oil. The iron seems unaffected, but what role does it play?

One theory is that carbon monoxide forms an iron carbonate on the surface of iron, the hydrogen reacting with this carbonate to form oil and leave the iron to continue its catalytic function.

By using radiocarbon to form a carbonate, and if the theory is correct, the oil should be radioactive. But the preliminary tests have resulted in non-radioactive oil.

Radioactive versions of nearly all elements are listed by the AEC. They can be produced in almost any reasonable quantity. Most of this work is being done at the Clinton pile. Almost unlimited facilities are available at the Hanford piles, for the process does not interfere with plutonium production.

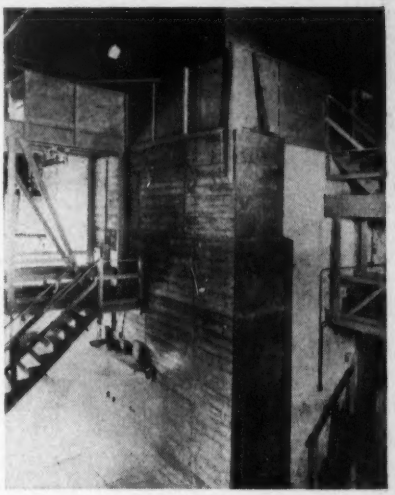
AEC Maintains Control

At present AEC keeps control over who uses isotopes. A small charge is made to cover out-of-pocket costs to the government. Isotopes for cancer research are furnished free.

Today half a dozen industries in the United States are ready to begin using radioisotopes in commercial operations. Experiments in commercial uses were conducted and completed during 1947. Two commercial uses appear ready for the bomb byproducts.

One steel company wants to use radiosulphur to regulate furnace operation—adding a trace of radiosulphur to the furnace charge to check transfer of sulphur. Since the radiosulphur acts the same as its non-radioactive relative, the sulphur will appear in the slag with no need for rule of thumb methods or chemical tests.

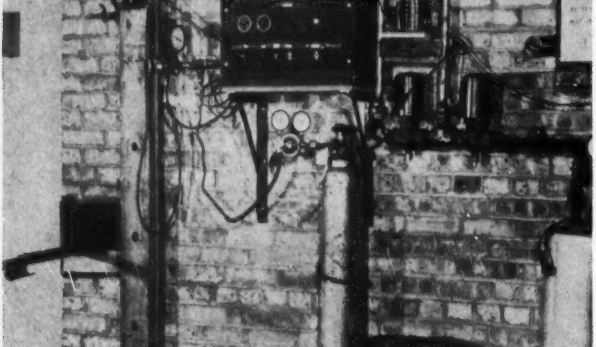
An oil company wants to use a radioactive gas to check underground passage of oil. If radioactive gas (say radio-argon) were entered in one well and appeared in nearby wells, producers could be certain of the existence of underground connections because of the presence of the radioactive gas in the oil of the second well.



Much of the scientific work with chain-reacting pile is carried out in an air-conditioned laboratory on top of pile. There, neutron beams for experimental purposes are allowed to come out of ports. Balconies to pile carry rods which control reaction.

Some chemical and pharmaceutical firms are now negotiating with AEC as to the possibilities of synthesizing radiocompounds on a business basis. This brings up the question again of government control. AEC can furnish a manufacturer with radiocompounds. The commercial concern would buy the radiocompounds, process them, and sell the product at a profit. But AEC wonders what might happen if a user of the commercial product becomes irradiated from using the product. Would AEC be legally or morally responsible for his contamination?

Enthusiasts say: sell isotopes cheap;



Rabbit pipe (lower left) carries materials into the pile for neutron irradiation. Compressed gas moves material into pile.

promote them vigorously; encourage industrial application. This policy will build up a market for future commercial use. Less enthusiastic people say: do that and you create an artificial boom based on subsidized prices. They want to wait for industrial applications until a commercial supplier of radioisotopes is ready to handle the market.

Power Applications

Development of atomic energy power plants has probably been slowed in the United States because there is no immediate need for this new power source. Most technicians agree that we could supply, with atomic fuel, a practically unlimited source of electrical power cheaper than from coal but more expensive than hydroelectric power. No matter where the plant is set up, costs will be about the same so far as fuel is concerned—the plant manager could bring the day's supply of fuel to work in his brief case.

With the world's supply of coal estimated at a 2,000-year reserve, no one becomes excited economically about a new source of power. True, the new power source might make cost a factor in plant location of some electro-processing industries. Plants could be built closer to the source of raw materials without thought of the local availability of a power source.

Such economic considerations, rather than technical factors, limit AEC's program for useful atomic energy applications. Some technicians believe that done on a work-it-out-as-you-go-along basis, a commercial-sized, reasonably-economical power plant could be developed by 1952. The commission has it scheduled for about 1960. By 1970 some people forecast that 20-25% of this country's power needs will be supplied by atomic energy.

The rest of the world is definitely more interested in power applications of atomic energy. In the Balkans or eastern Europe for instance, there is sufficient industrialization, coupled with a fuel shortage plus expensive transportation facilities, that the area could use atomic power. In coal-short Britain, it is believed that the bulk of her $120-million atomic budget is devoted to power applications.

It is believed that the first substantial power plant applications will appear outside the U. S.

The only nuclear reactor in existence today capable of delivering its energy output in usable form is the fast neutron reactor at Los Alamos. Fueled by pure plutonium, it employs no moderator. It

is, in reality, a controlled atom bomb. Put in operation in November 1946, the reactor delivers energy at a fairly high, usable temperature. Its primary purpose is to study bomb physics but it is yielding valuable power plant information.

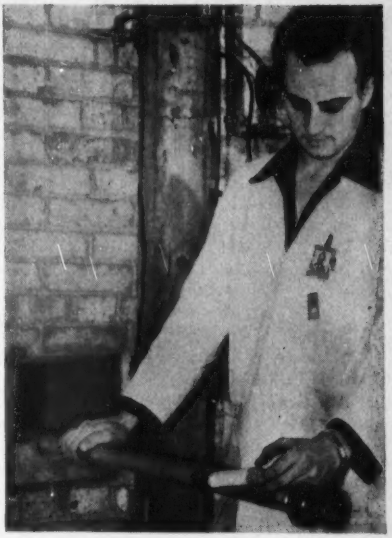
A second high-temperature pile under construction at Brookhaven National Laboratory is scheduled for operation in 1949. Some electric power may be generated by this pile. Primary purpose of this pile is to produce neutron beams and perform irradiations. It is to be an air-cooled, carbon modified pile fueled with uranium. It will operate above 1,000-kw.; the cooling air will emerge hot enough to generate steam.

The first reactor that can be termed a power generation pilot plant is the Zinn pile at Argonne National Laboratory. Start of construction awaits AEC approval; it will take 1½-2 yr. to construct. Purpose of the pile is to get power out in usable form. A fast-neutron pile, it will operate at a high power level and at temperatures comparable to current steam plants.

Two reactors, specifically designed for electric power generation, are planned by AEC. One is the General Electric Co. reactor at Knolls Atomic Power Laboratory. Nothing is known of this pile except that it will run at a high enough power level to give information on practical power generation.

The problem of heat-transfer fluid appears to be solved with sodium alloyed with potassium to lower the melting point. Sodium doesn't absorb neutrons, doesn't become seriously radioactive, has good thermal properties. Although it reacts violently with water, a special heat exchanger has now eliminated the trouble.

Nor does the problem of structural materials for reactors look now as appalling as it did a year ago. Metallic titanium is being considered as a major load-carrying material; it can resist temperatures as high at 2500° F. Beryllium and zirconium are being studied for they



Close-up of material being entered in rabbit pipe for injection into pile.

contain nuclear properties which make them valuable in themselves.

Breeder Piles

People ask: Is nuclear fuel so scarce that atomic energy must always be rigidly controlled? Or: Is it so plentiful that it becomes a major power source?

Uranium is a fairly plentiful metal. It is found in many countries of the world. However, only one part in 140 is naturally fissionable. But when U235 is consumed in a reactor, some of the U238 is transmuted into fissionable plutonium. This helps to replenish the fuel supply. If a half a pound of plutonium were produced from every pound of U235 burned, only one part in 70 of the thorium is used.

But suppose a pound of plutonium came from each pound of fuel burned, then you can utilize all the uranium. If a pound plus of plutonium were pro-

Atomic Glossary

To aid readers of this atomic story, this glossary is added.

Atom—*Smallest chunk of matter which has normal chemical properties. Chemical behavior is controlled by negative electricity surrounding nucleus.*

Atom bomb—*Essentially a gun and target combination. Gun's projectile is a sub-critical mass of fissionable material. So is the target.*

Breeder pile—*Any reactor in which the amount of fissionable material produced by transmutation is greater than the fissionable material consumed by the reaction.*

Carbon pile—*A reactor using graphite as a moderator.*

Enriched material—*Uranium containing a higher than normal proportion of U235.*

Fast-neutron reactor—*Reactor fueled with enriched material, needing no moderator.*

Fission—*Splitting of an atom into two atoms of more or less equal weight.*

Fission chain reaction—*Fissionable atom splits when it absorbs a neutron. In splitting it throws out more neutrons causing further splitting in a continuing chain.*

Fissionable material—*An atom which will split when it absorbs a slowly moving neutron.*

Fission product—*Atoms formed by the broken pieces of a split atom. Usually very radioactive.*

Isotope—*A particular combination of neutrons and protons forming an atom nucleus. Isotopes of different weight may have the same electric charge, have identical chemical properties, and are called isotopes of the same element.*

Moderator—*Material in a reactor to slow the neutrons emitted in fission. Common moderators: graphite, beryllium, heavy hydrogen.*

Pile—*Same as reactor, most often used for slow-neutron reactor.*

Neutron—*A heavy sub-atomic particle with no electrical charge.*

Plutonium—*An artificial heavy element, fissionable, formed by a neutron striking a U238 atom.*

Radioactivity—*Emission of energy by an atom.*

Radio-isotope—*An unstable isotope which shifts itself to stable form by spitting-out particles of its nucleii, electrons, or energy waves.*

Reactor—*Any device in which a fission chain reaction can be maintained.*

Thorium—*One of the heavy elements. When struck by a neutron it is transmuted into U233.*

Transmuted—*Artificial conversion of an atom of one element into an atom of another element.*

Uranium—*Also a heavy metal resembling lead, heaviest of the natural elements.*

duced, a "breeder pile" is produced which would provide fuel constantly.

Thorium—more plentiful than uranium—if exposed to chain reaction, is transmuted into fissionable U233. If 1 to 1 breeding were possible, this would add thorium to fuel supply.

Breeding is possible. When a U235 atom splits it throws out on the average something over 2.2 neutrons. Only one of these is needed to split another U235 atom. If another neutron is used to transmute a U238 atom into plutonium that leaves a margin for loss if the loss is small enough.

Guarded commitments indicate that current neutron losses are too great to permit breeding. But new piles on the drawing boards are believed efficient enough to breed fuel.

If this proves to be true, we have an atomic fuel source for thousands of years.—*Report to McGraw-Hill publications from the Washington Bureau.*

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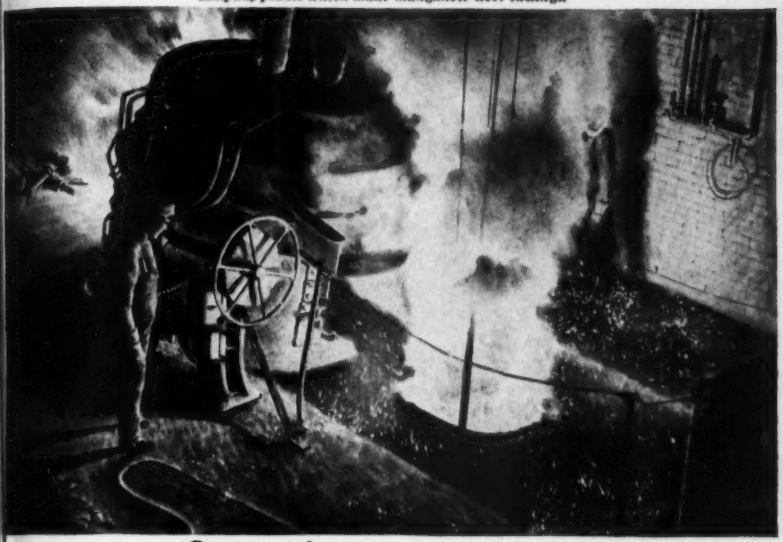

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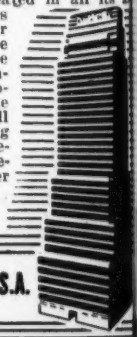

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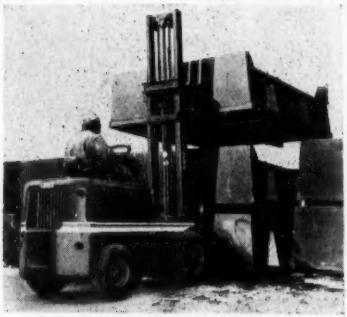

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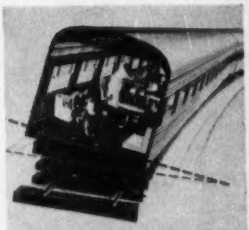

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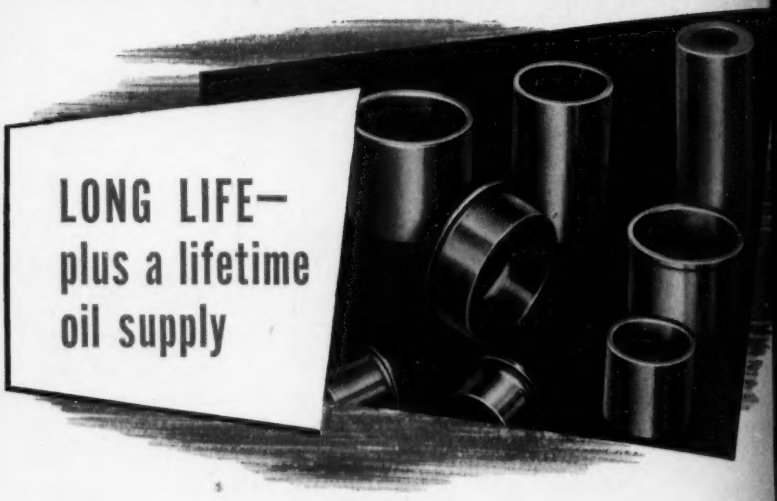

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